

**United States Department of the Interior  
Bureau of Land Management**

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**Environmental Assessment DOI-BLM-NM-P020-2015-0586-EA**

**HB AMAX Solution Mine Extension Project**

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## Acronyms and Abbreviations

%	percent
°C	degrees Celsius
°F	degrees Fahrenheit
µg/m <sup>3</sup>	micrograms per cubic meter
1st	first
3rd	third
ac-ft	acre-feet
amsl	mean sea level
API	American Petroleum Institute
AQB	Air Quality Bureau
AQCR	Air Quality Control Region
AMAX	AMAX-Horizon Mine
ATV	all terrain vehicle
AUM	animal unit month
BLM	Bureau of Land Management
CAA	Clean Air Act
CFO	Carlsbad Field Office
CFR	Code of Federal Regulations
CH <sub>4</sub>	methane
CO	carbon monoxide
CO <sub>2</sub>	carbon dioxide
CO <sub>2</sub> e	carbon dioxide equivalents
COA	conditions of approval
CP	Capitan Basin
CR	County Road
CVEC	Central Valley Electric Co.
CWA	Clean Water Act
db	decibels
DDT	dichlorodiphenyltrichloroethane
EA	Environmental Assessment
EIS	HB In-Situ Solution Mine Project Environmental Impact Statement
E.O.	Executive Order
ESA	Endanger Species Act
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FLPMA	Federal Land Policy and Management Act
FT	Federally Threatened Species List
ft	feet/foot
ft/day	feet per day
GHG	Greenhouse Gases
gpm	gallons per minute
gwp	Global Warming Potential

HAP	Hazardous Air Pollutants
HDPE	high density polyethylene
HUC	Hydrologic Unit Code
Intrepid	Intrepid Potash – New Mexico, LLC
KCl	potassium chloride, sylvite
MBTA	Migratory Bird Treaty Act
mg/L	milligrams per liter
MMPA	Mine and Mineral Policy Act
NAAQS	National Ambient Air Quality Standards
NaCl	sodium chloride
NE	Northeast
NEPA	National Environmental Policy Act
NHD	National Hydrography Dataset
NHPA	National Historic Preservation Act
NM	New Mexico
NM-E	New Mexico - State listed as Endangered Species
NM-T	New Mexico - State listed as Threaten Species
NMAAQs	New Mexico Ambient Air Quality Standards
NMAC	New Mexico Administrative Code
NMDOT	New Mexico Department of Transportation
NMED	New Mexico Environment Department
NMOSE	New Mexico Office of State Engineer
NMSA	New Mexico Statutes Annotated
NMWQCC	New Mexico Water Quality Control Commission
NOITP	Notice of Intent to Plug
NO <sub>x</sub>	nitrogen oxides
NO <sub>2</sub>	nitrogen dioxide
N <sub>2</sub> O	nitrous oxide
NRCS	National Resources Conservation Service
NW	Northwest
NWI	National Wetland Inventory
O <sub>3</sub>	ozone
OHV	off highway vehicle
PBPA	Permian Basin Programmatic Agreement
PCB	polychlorinated biphenyl
PFYC	Potential Fossil Yield Classification
PM <sub>10, 2.5</sub>	Particular Matter (< 10 microns, <2.5 microns)
ppm	parts per million
psi	pounds per square inch
PTI	Pilot/Testing/Instrumentation
R30E	Range 30 East
ROD	Record of Decision
ROW	right of way
RV	recreation vehicle
SDR	Standard Dimension Ratio

SE	Southeast
SHPO	State Historic Preservation Office
SO <sub>2</sub>	sulfur dioxide
SPA	Secretary's Potash Area
SPCC	Spill Prevention, Control, and Countermeasure
SRMA	Special Recreation Management Area
SSURGO	Soil Survey Geographic Database
STH	State Trunk Highway
SWPPP	Storm Water Pollution Prevention Plan
SWQB	Surface Water Quality Bureau
SWReGAP	Southwest Regional Gap Analysis Project
T19S	Township 19 South
TD	total depth
TDS	total dissolved solids
TSP	total suspended particulates
tpy	tons per year
U.S.	United States
USC	United States Code
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish & Wildlife Service
UWI	Unique Well Identification
VOC	Volatile Organic Compound
VRM	Visual Resource Management
WIPP	Waste Isolation Pilot Plant
WRCC	Western Regional Climate Center

# 1. PURPOSE AND NEED FOR ACTION

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## 1.1. Background

Intrepid Potash – New Mexico, LLC (Intrepid) is proposing to use solution mining to extract potash, a potassium compound commonly used in fertilizer, which remains in the abandoned underground AMAX-Horizon Mine (AMAX) workings. The HB AMAX Solution Mine Extension Project would be an extension to Intrepid's existing HB Solar Solution Mine located in Eddy County approximately 20 miles east of Carlsbad, New Mexico. The AMAX Mine is a closed conventional mine that lies to the north of the HB Solar Solution Mine. The Proposed Project is designed to recover and process potassium chloride (KCl) ore from the abandoned underground mine workings of the AMAX Mine.

The HB AMAX Solution Mine Extension Project would tie directly into Intrepid's existing HB AMAX Solution Mine Extension Project and would expand the size and extend the life of that mine. The Bureau of Land Management (BLM) evaluated the HB Solar Solution Mine (formerly known as the HB In-Situ Solution Project) by preparing an Environmental Impact Statement (EIS), DOI-BLM-NM-P020-2011-498-EIS. A final EIS (FEIS) was published in January 2012 and a Record of Decision (ROD) followed in March 2012.

The BLM Carlsbad Field Office is evaluating the proposed HB AMAX Solution Mine Extension Project with this Environmental Assessment (EA). This EA is tiered from HB Solar Solution Mine EIS and therefore made a part hereof. A brief project description follows, which details how the proposed HB AMAX Solution Mine Extension Project would use existing infrastructure and employ techniques that would minimize impacts. A more detailed description of the project and associated infrastructure can be found in Section 2, Proposed Action.

## 1.2. Brief Project Description

Intrepid holds the federal, State, and private potassium leases for the area of proposed potash extraction. Surface disturbance would occur on BLM, State, and fee lands depending upon the final project alignment. The AMAX Mine would provide approximately 14 years of solution mine reserves beyond the 28-year HB Solar Solution Mine life.

To the maximum extent practicable, it is proposed that the HB AMAX Solution Mine Extension Project would utilize existing HB Solar Solution Mine facilities and infrastructure to minimize environmental impacts. The solution mining process would be identical to that of the existing HB Solar Solution Mine with injection of salt (NaCl) saturated brine into the workings and extraction of a KCl (potash) enriched (pregnant) brine. Potash recovered from the AMAX Mine would be pumped to the existing HB Solar Solution Mine solar evaporation ponds. Once the solution evaporates in the ponds and precipitates out KCl and NaCl, the salts would be harvested and transported to the existing HB Mill for ore refinement.

## 1.3. Purpose and Need for Action

The purpose of this action is to modify Intrepid's HB Solar Solution Mine workings to include the AMAX Mine in order to recover potash resources.

The BLM is required to evaluate and respond to Intrepid's proposal to construct, operate, maintain, and decommission an in-situ solution mining operation, which is described in Section 2, Proposed Action. This includes analyzing the impacts of the proposed mine plan modification and the lease conversion from conventional mining to solution mining leases. The need for this project is established by the BLM responsibility to promote the orderly and efficient development and maximum recovery of leasable minerals, including potash, as specified under 30 United States Code (USC) Chapter 2 §21a, the Mineral Leasing Act of 1920 as amended, the Federal Land Policy and Management Act (FLPMA) of 1976



(43 USC 1761), and the Secretary of the Interior's 1986 Potash Order (51 Federal Register 39425, October 28, 1986).

The BLM is responsible for the balanced management of the public lands and resources and its various values in a fashion that will best serve the needs of the American people. Potash is an important industrial mineral in wide demand in the United States (U.S.) with limited production in the U.S. The BLM has the duty to allow and encourage a federal leaseholder to develop their leases subject to reasonable restrictions. The proposed project will fulfill the BLM mission and responsibilities by allowing Intrepid to mine potash and associated minerals for which it holds federal leases.

## **1.4. Conformance with Applicable Land Use Plan(s)**

The Proposed Action, as described in Section 2, is in conformance with the 1988 Carlsbad Resource Management Plan, as amended by the 1997 Carlsbad Resource Management Plan Amendment for Oil and Gas, and the 2008 Special Status Species Resource Management Plan Amendment.

## **1.5. Relationship to Statutes, Regulations or Other Plans**

The BLM authority for land management derives from the Federal Land Policy and Management Act (FLRPA). All BLM regulations are contained in 43 Code of Federal Regulations (CFR), Subtitle B—Regulations Relating to Public Lands, Chapter II—Bureau of Land Management, Department of the Interior. BLM regulations for the management of mining on federal potash leases are found in 43 CFR Subpart 3590, Solid Minerals (Other Than Coal) Exploration and Mining Operations. Section 3592.1, Operating Plans, specifies that before any operations are conducted under any lease, the operator must submit a detailed mine and reclamation plan to the BLM, which the BLM must approve before operations can begin. These regulations contain specific criteria that the mine and reclamation plan must address to assure the protection of non-mineral resources and the reclamation of the lands affected by the operations.

Potash is a solid leasable mineral that is managed by the BLM under the authority of the Mineral Leasing Act of 1920, as amended, the Potash Leasing Act of 1927, and, in southeastern New Mexico, Secretary of the Interior Order No. 3324, dated December 3, 2012 (2012 Secretary's Order). The Mineral Leasing Act establishes qualifications for mineral lessees, defines maximum limits on the total acres of a mineral that can be held by a lessee, and authorizes the BLM to grant these leases. Federal regulations that pertain to leasing these minerals are contained in 43 CFR Part 3500, Leasing of Solid Minerals Other than Coal and Oil Shale.

The State of New Mexico's Order No. R-111-P applies to State lands and minerals in the area. While the BLM may incorporate elements of R-111-P into its management of the Secretary's Potash Area (SPA), the BLM is not mandated to follow it. In particular, Life of Mine Reserves, as defined in R-111-P, is not used for management of federal lands and minerals.

The Mining and Mineral Policy Act of 1970 (MMPA) mandates that federal agencies ensure that closure and reclamation of mine operations be completed in an environmentally responsible manner. The MMPA states that the federal government should promote the "development of methods for the disposal, control, and reclamation of mineral waste products, and the reclamation of mined lands, so as to lessen any adverse impact of mineral extraction and processing upon the physical environment that may result from mining mineral activities."

Other major federal and State regulations and permits that are relevant to the proposed project include those listed below:

- National Environmental Policy Act (NEPA) (P.L. 91-190) and CEQ – Regulations for implementing NEPA (40 CFR Parts 1500 – 1508)

- Clean Water Act (CWA) and Federal Water Pollution Control Act Amendments
- New Mexico Water Quality Act, New Mexico Statutes Annotated (NMSA) 1978, §§74- 6-1 et seq.
- Federal Safe Drinking Water Act, 40 CFR Parts 144 and 147; New Mexico Ground and Surface Water Protection, New Mexico Administrative Code (NMAC) Part 20.6.2, 2005
- Underground Water, NMSA 1978, §§72-12-1 et seq.
- Endangered Species Act (ESA) of 1973, as amended (P.L. 93- 205)
- Migratory Bird Treaty Act (MBTA) of 1918, as amended; Bald and Golden Eagle Protection Act of 1940
- Clean Air Act (CAA); delegated to the State of New Mexico under Air Quality Control Act, NMSA 1978, §§74-2-1 through 74-2-17
- National Historic Preservation Act (NHPA) (36 CFR Part 800); New Mexico Cultural Properties Act, NMSA 1978, §§18-6-1 through 18-6-17
- Federal Cave Resources Protection Act of 1988, 16 USC 4301 – 4309
- P. L. 111-011 Omnibus Public Land Management Act, Subtitle D – Paleontological Resources Preservation
- NMSA 1978 Sections 19-1-1 and 19-7-57
- NMAC Part 14.5.2

## **1.6. Decision to be Made**

The decision to be made is whether or not to approve Intrepid's application to extend the existing HB Solar Solution Mine workings to include the AMAX Mine, and, if to approve, under what terms and conditions.

## **1.7. Scoping, Public Involvement, and Issues**

Summary of Public Outreach Activities from the HB Solar Solution Mine EIS:

### **EIS Public Outreach**

September 16, 2008 – two public scoping meetings

Prior to publication of the EA, the BLM determine that the preparation of an EIS would be required for the proposed project

January 12, 2010 – Notice of Intent to prepare an EIS was published in the Federal Register

January 26, 2010 – two public scoping meetings

April 15, 2011 – Notice of Availability for the Draft EIS was published in the Federal Register

May 10, 2011 – public meeting in Carlsbad

May 11, 2011 – public meeting in Hobbs

### **EIS Consultation and Coordination**

February 1, 2010 – BLM Carlsbad Field Office (CFO) sent letters to the following pueblos and tribes notifying them of the proposed HB Solar Solution Mine project:

- Apache Tribe of Oklahoma

- Comanche Indian Tribe
- Hopi Tribe
- Kiowa Tribe of Oklahoma
- Mescalero Apache Tribe
- Pueblo of Isleta
- Ysleta del Sur Pueblo

### **EA Scoping**

Materials documenting scoping and public outreach can be found in Appendix A. Public luncheons sponsored and facilitated by Intrepid were held in late August 2014 to inform interested stakeholders about the project.

A Purpose and Need statement and brief description of the Proposed Action were posted on the BLM website on Wednesday, March 18, 2015 for a 30-day scoping period. A reminder email about the scoping period was sent to all landowners within or adjacent to the project boundary on April 2, 2015. The distribution list included people that attended the public luncheons in August 2014, and stakeholders that had been identified during the scoping period for the HB Solar Solution Mine EIS. The public was respectfully asked to provide comments by April 17, 2015.

As a result of scoping, one public comment was received from the Mayor of Carlsbad.

The following is a list of specific issues identified by the BLM and the public for this EA:

- Geological resources – concern over actual drawdown impacts to caves in comparison to the model predictions, potential for subsidence, oil and gas operations, potential of impacts to paleontology
- Water resources – performance of the Rustler wells in comparison to the model predictions, minimizing fresh water use
- Soils – erosion
- Air quality – emissions and dust
- Vegetation – noxious weeds
- Wildlife – raptors, bats, owls
- Rangeland and Livestock grazing – impacts to grazing and cattle
- Lands and Realty – impacts to ROW
- Recreation – ensure the EA addresses recreational use in the area
- Visual – impacts to visual resources
- Cultural – avoidance of known sites
- Hazardous Materials – potential for releases
- Socioeconomics – benefits and impacts to the area
- Project infrastructure – use of existing infrastructure
- EA approach – tier the EA from the EIS

## 2. PROPOSED ACTION

### 2.1. Introduction

Intrepid is proposing to expand solution mining activities permitted for the HB Solar Solution Mine to include portions of the abandoned AMAX Mine. The HB Solar Solution Mine and the proposed HB AMAX Solution Mine Extension Project are located in Eddy County approximately 20 miles east of Carlsbad, New Mexico (see **Map EA-1 – Project Location and Vicinity Map**).

The HB AMAX Solution Mine Extension Project would expand Intrepid's existing HB Solar Solution Mine and is proposed as a Mine Plan Modification of Intrepid's existing HB Solar Solution Mine Operations and Closure Plan, dated March 9, 2012. With regard to federal lands, the proposed extension project lies completely on potassium leases held by Intrepid and thus can be permitted as a mine plan modification. No separate rights of way (ROW) in addition to the mine modification are proposed for in this project.

The proposed HB AMAX Solution Mine Extension Project is located within State, federal, and private leases that Intrepid currently holds. As part of this Proposed Action all federal potassium leases associated with the proposed HB AMAX Solution Mine Extension Project would be converted from conventional mining leases to solution mining leases. The same conversion of lease type was analyzed for the existing HB Solar Solution Mine EIS (see ROD). Four federal potash leases are to be converted from conventional mining leases to solution mining leases. These leases are listed in **Table 2.1-1 - Existing and Proposed HB Solar Solution Mine Facilities** as shown on **Map EA-2 – Mineral Lease**.

**Table 2.1-1 Existing and Proposed HB Solar Solution Mine Facilities**

Lease Number	Total Lease Acreage
NMLC-046729-D	2,560.0
NMNM-113455	2,400.8
NMNM-113456	2,480.0
NMNM-113457	560.6

The AMAX Mine ceased production in 1993 and has been closed according to applicable regulatory requirements. The shafts have been sealed and the surface restoration and reclamation activities have been completed by the former owner. The remaining ore is located in the pillars and fringe areas of the underground mine workings.

Conventional mining at the AMAX property occurred on the 1<sup>st</sup> and 3<sup>rd</sup> Ore Zones. The 3<sup>rd</sup> Ore Zone lies stratigraphically above the 1<sup>st</sup> Ore Zone with roughly 30 feet (ft) of separation between them. The two Ore Zones are connected by several slopes and stopes that would allow injected brine to move vertically providing contact to ore in pillars and fringe areas from both ore zones.

The HB AMAX Solution Mine Extension Project would utilize existing facilities wherever possible. The infrastructure associated with the HB Solar Solution Mine and the proposed HB AMAX Solution Mine Extension Project is shown in **Map EA-3 – Existing and Proposed HB Solar Solution Mine Facilities**. All existing infrastructure for the HB Solar Solution Mine that would be also used by the HB AMAX Solution Mine Extension Project was previously analyzed in the HB EIS.

As shown on Map EA-3, new construction for the HB AMAX Solution Mine Extension Project would include:

- Two injection wells with 150 ft by 250 ft construction areas and 80 ft by 80 ft operational areas.
- Two extraction wells with 150 ft by 250 ft construction areas and 80 ft by 80 ft operational areas.

- Two Pilot/Testing/Instrumentation (PTI) wells; one PTI well immediately adjacent to each extraction well and contained within each 80 ft by 80 ft operational area.
- 12.4 miles of 50-ft wide utility corridor that will include buried pipelines of various diameters (4 to 18 inches) and a 12-ft wide access road.
- One booster pump station with a 100 ft by 130 ft area for construction and operations; half of this area (50 ft by 130 ft) is a new disturbance and half is within the existing HB pipeline corridor.
- 1.6 miles of overhead electric lines.
- One additional source of injectate brine make-up water from the Intrepid North Plant scrubber water recycle system.

Due to uncertainty in the precise location of remaining ore pillars, it is possible that the initial boreholes for the injection and extraction wells could intersect an ore pillar and be unusable. If an ore pillar is intersected by the borehole the hole would be properly plugged and a second, twin hole would be drilled as close as possible to the original well location. The BLM would be notified of any twin holes.

The HB Solar Solution Mine currently utilizes several monitoring systems to verify and document operational conditions as required by the New Mexico Environment Department (NMED) and the BLM. All existing monitoring systems would be utilized for the proposed HB AMAX Solution Mine Extension Project and are summarized as follows:

- A groundwater monitoring well network used to collect regular water level and water quality data throughout the area potentially influenced by Rustler groundwater withdrawal.
- A groundwater monitoring well network used to collect regular water level, water quality, and electrical conductivity data to define baseline characteristics of the groundwater beneath the solar evaporation ponds and monitor for potential releases of solar pond brine.
- Regular water level measurements collected monthly to monitor water levels in specified karst and cave resources.
- Regular pipeline inspections by mine personnel and pipeline instrumentation that monitors pressure and flow rate to monitor for potential pipeline leaks.
- Down-hole instrumentation to guide extraction well and injection well operation and control flood elevations.
- Monitoring wells to detect potential brine excursions to down-gradient portions of the mine workings outside of flood zones.

## **2.2. HB AMAX Solution Mine Extension Mine Operation**

The solution mining process at the proposed HB AMAX Solution Mine Extension Project would be identical to that employed at the existing HB Solar Solution Mine. The proposed AMAX solution mining process is to inject a salt (NaCl) saturated brine into the AMAX workings. The brine would remain in place to allow an ion exchange to occur between KCl in the mine ore body and sodium in the brine (KCl in the ore body is dissolved and an equivalent amount of NaCl precipitates out from the brine). The result would be a potassium-rich (pregnant) brine to be extracted from the mine after a desired concentration of KCl is reached. Pregnant brine would be pumped to the existing HB solar evaporation ponds. Water in the pregnant brine would evaporate in the ponds and KCl and NaCl would precipitate out as solids. The precipitated salts would be harvested from the ponds and transported to the existing HB Mill for ore refinement. This process is described in detail in the HB EIS (Section 2.4.2.2).

Salt conditioned injectate brine would be pumped to injection wells located in upper elevations of the AMAX Mine and would flow to the lower areas of the flood zone. As injectate brine is added, a leach lake would form and rise to the maximum control elevation. After the brine is injected it would flow via advection (gravity induced, downhill flow) and dispersion (driven by density gradients developed as the brine becomes increasingly saturated with KCl). Although it would take time to fill the AMAX Mine (over two years at the maximum injection rate of 3,000 gpm), KCl dissolution is expected to occur quickly but may take several month to concentrate to the desired pregnant brine KCl grade. The in-situ process would leave behind insolubles (clay slimes) in the former workings eliminating the need for separation and disposal on the surface. Once the cavern is filled to the control level, long term production would become a relatively steady-state operation where injection roughly equals extraction. **Figure EA-1 - Proposed HB Operational Diagram** summarizes the cumulative HB solar solution mine processes including the proposed HB AMAX Solution Mine Extension Project.

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### **2.2.1. General Design Features Included to Avoid and Minimize Environmental Impact**

The following design features are common to all action alternatives. A number of design features and mitigation measures for the HB Solar Solution Mine were identified in the FEIS and approved in the ROD. Specific mitigation measures include:

1. ROD, Section 2.1 - Applicant-committed Environmental Protection Measures
2. ROD, Section 2.2 - BLM Environmental Protection Measures
3. EIS, Appendix B – Existing Potash Lease Stipulations and Potential Conditions of Approval for HB In-Situ Solution Mine EIS

In addition, according to the ROD, all monitoring, spill response, and remedial actions will comply with Intrepid's HB In-Situ Solution Mine Operations and Closure Plan (March 2012) approved by the BLM. Section 8.2.2, *Pipeline, Well, and Uncontained Mill Facility Releases* of the HB In-Situ Solution Mine Operations and Closure Plan (March 2012) states:

*The NMED and BLM, as appropriate, will be promptly notified of releases as required by Discharge Permit DP-1681. Inconsequential failures that do not threaten ground water quality shall be reported in the quarterly monitoring reports and include a brief action plan and completion report.*

The NMED Discharge Permit DP-1681 spill reporting requirements are as follows:

Section III. Permit Conditions, Number 30. Operational Failures

*In the event of a berm breach, pipeline break, pump failure or other system failure at the facility that threatens ground water as defined by 20.6.2.310 I NMAC, tailings and process waters shall be contained, pumped and/or transferred to areas of the facility that impose minimal impacts to ground water quality. Failed components shall be repaired or replaced as soon as possible and no later than 72 hours from the time of failure. Inconsequential failures that do not threaten ground water quality shall be reported in the quarterly monitoring reports and include a brief action plan and completion report. [20.6.2.31007A (I 0) NMAC]*

Section III. Permit Conditions, Number 32. Spill Reporting and Remediation

*In the event of a spill or release that is not prescribed under this Discharge Permit, IPNM shall initiate the notifications and corrective actions as required in 20.6.2.1203 NMAC. IPNM shall take immediate corrective action to contain and remove or mitigate the damage caused by the discharge. Within 24 hours after discovery of the discharge, IPNM shall verbally notify NMED and provide the information required by 20.6.2.1203.A.I NMAC. Within 7 days of discovering the discharge, IPNM shall submit a written reply to NMED verifying the oral notification and providing any additional information or changes. IPNM shall submit a corrective action report within 15 days after discovery of the discharge. [20.6.2.1203 NMAC]*

Those design features and mitigation measures would be included for the HB AMAX Solution Mine Extension Project facilities where applicable. Specific design features and mitigation measures identified by BLM resource specialists for the HB AMAX Solution Mine Extension Project are described below.

### **Solid Minerals**

1. A qualified person would be onsite at all times to monitor construction activities for compliance with federal and State permits and requirements. This construction monitor would report to the BLM on a regular basis. Intrepid would notify the BLM at least 3 working days prior to commencing construction of access roads and/or pads.
2. Intrepid would obtain prior written approval from the BLM of any construction not authorized in a previously approved plan. Notification to the BLM of the activity would be in the form of a written mining plan modification.
3. A closed-loop fluid control system would be used to contain drill fluids and cuttings.
4. A bermed, synthetic lined pit or roll-off containers would be constructed to contain fluids and cuttings and to prevent fluids from seeping into the underlying soils. Berms would be placed around the lined pit with the liner extending beyond the crest of the berm and anchored in place. In addition, a berm shall be constructed on the down-slope portion of the pad as secondary spill containment.
5. If the site would be left unattended before removing the closed-loop system and underlying liner, a fence constructed with T-posts and 3 strands of barb wire will be placed around the outside perimeter of the berm, completely enclosing the lined fluid and cutting pit to prevent people and cattle from accessing the pit .
6. Intrepid would notify BLM a minimum of 24 hours in advance for a representative to witness:
  - a. Spudding wells
  - b. Drilling
  - c. E-logging, if performed
  - d. Cementing
  - e. Reclamation (seeding)
7. In the event of an off-pad spill, unauthorized discharge, or soil contamination, the operator or person in charge would provide notification to the BLM as approved by BLM in the AMAX Mine Operations and Closure Plan and as required by NMED Discharge Permit DP-1681.
8. All well information would be supplied to the BLM Carlsbad Field Office. The required information includes:
  - Drilling reports.
  - Well completion report including casing intervals, cements zones, and screened intervals.

- Geologic log of the hole, including any drilling events encountered (e.g., lost circulation, air/gas blows, etc.).
  - If geophysical logs are run, a copy of each log shall be submitted. The log submitted can be either in paper or digital format.
9. Any water erosion that may occur due to the construction of roads or well pads or during the life of the wells will be corrected in a timely manner and proper measures would be taken to prevent future erosion.

### ***Fluid Minerals***

1. Operations would not be conducted which in the opinion of the Authorized Officer would constitute a hazard to oil and gas production or that would unreasonably interfere with the orderly development and production under any oil and gas lease issued for the same lands.
2. Lost circulation zones (the uncontrolled flow of drilling fluid into flows into one or more geological formations instead of returning up the annulus of the drill) would be logged and reported in the drilling report so BLM can assess the situation and work with the operator on corrective actions.
3. To protect freshwater bearing units, freshwater mud would be used to drill down through the Rustler Formation and the Rustler Formation section of the borehole would be cased/cemented.

### ***Lands and Realty***

1. All aboveground structures not subject to safety requirements would be painted by the holder to blend with the natural color of the landscape. The paint used would be color which simulates "Standard Environmental Colors" – Shale Green, Munsell Soil Color No. 5Y 4/2.
2. The pipeline would be identified by signs at the point of origin, the point of termination, and at all road crossings. At a minimum, signs would state the holder's name, BLM lease/serial number, and the product being transported. All signs and information thereon would be posted in a permanent, conspicuous manner, and will be maintained in a legible condition for the life of the pipeline.
3. Intrepid would not use the pipeline route as a road for purposes other than inspection and routine maintenance as determined necessary by the Authorized Officer in consultation with Intrepid before maintenance begins. Intrepid would take whatever steps are necessary to ensure that the pipeline route is not used as a roadway. As determined necessary during the life of the pipeline, the Authorized Officer may ask Intrepid to construct temporary deterrence structures.
4. All construction and maintenance activity would be confined to the authorized corridor. No additional disturbance beyond that in the approved plan shall take place.

### ***Wildlife***

1. Mine related activities, including drilling, would not be allowed in lesser prairie-chicken habitat during the period from March 1st through July 15th, annually. During that period, other activities that produce noise or involve human activity, such as pipeline, road, and well pad construction, would be allowed except between 3:00 a.m. and 9:00 a.m. Noise from well heads and pump booster station would be muffled or otherwise controlled so as not to exceed 75 decibels (db) measured at 30 ft from the source of the noise.



- a. The 3:00 a.m. to 9:00 a.m. restriction would not apply to normal, around-the-clock operations, such as pumping, which do not require a human presence during this period. Normal vehicle use on existing roads would not be restricted.
  - b. Exceptions to these requirements will be considered for areas of no or low prairie chicken booming activity, or unoccupied habitat, including leks, as determined at the time of permitting, or in emergency situations.
2. In order to prevent raptor perching and improve the probability of maintaining a stable lesser prairie-chicken population, upon abandonment of wells a low profile abandoned well marker would be installed. The well marker would be approximately two inches aboveground level and contain the following information: operator name, lease name, and well number and location, including unit letter, section, township, and range. The previous listed information will be welded, stamped, or otherwise permanently engraved into the metal of the marker.
3. Escape Ramps - the operator would construct and maintain pipeline/utility trenches that are not otherwise fenced, screened, or netted to prevent livestock, wildlife, and humans from becoming entrapped. At a minimum, the operator will construct and maintain escape ramps, ladders, or other methods of avian and terrestrial wildlife escape in the trenches according to the following criteria:
  - a. Any trench left open for (8) hours or less is not required to have escape ramps; however, before the trench is backfilled, an agency approved monitor shall walk the entire length of the open trench and remove all trapped vertebrates. The bottom surface of the trench will be disturbed a minimum of 2 inches in order to arouse any buried vertebrates. All vertebrates will be released a minimum of 100 yards from the trench.
  - b. For trenches left open for eight (8) hours or more, earthen escape ramps will be provided. Earthen escape ramps and/or structures (built at no more than a 30 degree slope and spaced no more than 500 feet apart) shall be placed in the trench. Metal structures will not be authorized. One approved monitor shall be required to survey up to three miles of trench between the hours of 11 AM-2 PM. A daily report (consolidate if there is more than one monitor) on the vertebrates found and removed from the trench shall be provided to the BLM (email/fax is acceptable) the following morning. Prior to backfilling of the trench all structures used as escape ramps will be removed and the bottom surface of the trench will be disturbed a minimum of 2 inches in order to arouse any buried vertebrates. All vertebrates will be released a minimum of 100 yards from the trench. Open trenches will have ramps, bridges, or earthen plugs, at least six feet wide, every one-quarter mile to pass livestock and wildlife. Earthen plugs would be placed at obvious game or livestock trails that cross the trench.
4. Should it be documented that bats are found to be drinking from the solar evaporation ponds, and should this be proven to be detrimental to bats, mitigation measures would be collaboratively developed by the BLM and the operator.

### ***Archaeology***

Should discoveries of human remains or funerary objects occur during project construction or operations on federal land with the PBPA area, Intrepid would cease operations in the area of discovery, protect the remains, and notify the BLM within 24 hours. The BLM would determine the appropriate treatment of the remains in consultation with culturally affiliated Indian Tribe(s) and lineal descendants. Intrepid would be required to pay for treatment of the cultural items independent and outside of the mitigation fund. In all cases it is illegal to remove any type of cultural item from Federal land.

Any cultural resource (historic site, object, or remains) discovered by the Intrepid, or any person working on Intrepid's behalf, on State land shall be immediately reported to the State Historic Preservation Office (SHPO). The holder shall suspend all operations in the immediate area of such discovery until written

authorization to proceed is issued by the SHPO. The authorized officer shall determine the appropriate actions necessary in order to prevent the loss of significant cultural or scientific values. The holder would be responsible for the cost of evaluation and any measures necessary to mitigate the site as determined by the Authorized Officer with consultation with the Intrepid.

### ***Paleontology***

Any paleontological resource discovered by Intrepid or any person working on Intrepid's behalf, on Federal land shall be immediately reported to the Authorized Officer. Intrepid shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. The Authorized Officer shall determine the appropriate actions necessary in order to prevent the loss of significant paleontological or scientific values. Intrepid will be responsible for the cost of collection, evaluation and curation and any measures necessary to mitigate the site as determined by the Authorized Officer in consultation with Intrepid.

### ***Cave-Karst***

1. Turnout ditches and drainage leadoffs would not be constructed in such a manner as to increase or decrease the natural flow of water into or out of cave or karst features.
2. Intrepid will inform the BLM, Carlsbad Field Office, immediately if any subsurface drainage channels, cave passages, or voids are penetrated during construction and no further construction would be done until clearance has been issued by the Authorized Officer. Special restoration stipulations or realignment may be required.
3. Intrepid will submit a pipeline leak detection plan to BLM for approval prior to operational start.
4. Intrepid will report all spills or leaks to the BLM as required by the BLM-approved HB Mine Operations and Closure Plan and NMED Discharge Permit DP-1681.
5. Intrepid will notify the BLM if the water level in the Burton Flats karst monitoring wells drops below the threshold outlined in groundwater adaptive management plan.

### ***Hydrology***

1. Fresh water or fresh water spud mud would be used to drill to surface casing depth. If surface casing is set at a lesser depth than the top of the Rustler Formation, fresh water mud may be used to drill down to the first salt in the Salado Formation after which brine must be used.
2. While drilling from the surface casing to the Rustler Formation operators would periodically sweep the hole with viscous low water loss additives to help build a filter cake across usable water zones in the redbeds, if encountered.
3. Surface casing would be set at a sufficient depth to protect usable water zones and cement circulated to surface. In areas where the salt section (Salado) is present, surface casing would be set at least 25 ft into the top of the Rustler Anhydrite and cement circulated to the surface. As an alternative, surface casing would be set through the Santa Rosa Formation or other potable water bearing zones and circulate cement to surface.

### ***Rangeland, Noxious Weeds, and Soils***

1. Intrepid would minimize disturbance to existing fences and other improvements, such as structures that provide water to livestock (i.e., windmills, pipelines, drinking troughs, and earthen reservoirs), on public lands. Intrepid would promptly repair improvements to at least their former state. Functional use of these improvements would be maintained at all times. Intrepid would

contact the owner of any improvements prior to disturbing them. When necessary to pass through a fence line, the fence would be braced on both sides of the passageway prior to cutting of the fence. No permanent gates will be allowed unless approved by the Authorized Officer.

2. In those areas where erosion control structures are required to stabilize soil conditions, Intrepid would install such structures as are suitable for the specific soil conditions being encountered and which are in accordance with sound resource management practices.
3. Intrepid would be held responsible if noxious weeds become established within the areas of operations. Weed control would be required on the disturbed land where noxious weeds exist, which includes associated roads, pipeline corridor and adjacent land affected by the establishment of weeds due to this action. Intrepid would consult with the Authorized Officer for acceptable weed control methods, which include following EPA and BLM requirements and policies.
4. If a fence is crossed during lease operations, to prevent slacking of fence wire, Intrepid would brace and tie-off each existing fence to be crossed before cutting. During construction, the opening shall be protected to prevent the escape of livestock. Fences cut during construction would be restored by Intrepid to a condition which is equal to or better than the original. Cattle guards would be installed in any fence where a road created during construction is to be regularly traveled.
5. Gates or cattle guards on public lands would not be locked or closed to public use by Intrepid. Gates would be kept closed at all times unless the grazing allottee requests them to be left open.
6. Prior to any construction, Intrepid would notify the grazing allottee or the surface owner, in the case of private ownership, of the activity.

### ***Recreation***

1. Power poles and associated ground structures (poles, guy wires) would not be placed within 20 ft of recreation trails. Guy wires would be equipped with a sleeve, tape or other industry approved apparatus that is highly visible during the day and reflective at night.
2. Appropriate safety signage would be in place during all phases of the project.
3. Upon completion of construction, trails would be returned to pre-construction condition.

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### ***2.2.2. Proposed Construction***

The proposed new construction required for the HB AMAX Solution Mine Extension Project includes new injection wells, extraction wells (with associated PTI wells), well head components, conveyance pipelines, booster pump station, power distribution facilities, and access roads. The following subsections present details of the proposed infrastructure and the design features related to environmental protection.

#### ***Injection/Extraction Well Locations***

Two injection and two extraction wells are proposed to provide conduits to flood the target ore zones as follows:

- **IP-301** 1<sup>st</sup> Ore Zone Injection Well  
NW ¼, SE ¼, Section 8, T19S, R30E
- **IP-302** 1<sup>st</sup> Ore Zone Extraction Well  
NE ¼, SE ¼, Section 10, T19S, R30E

- **IP-303** 3<sup>rd</sup> Ore Zone Injection Well  
SE ¼, SE ¼, Section 5, T19S, R30E
- **IP-304** 3<sup>rd</sup> Ore Zone Extraction Well  
NE ¼, NE ¼, Section 14, T19S, R30E

A twin hole may be drilled adjacent to the original location if the initial borehole is unsuccessful. The injection and extraction wells are classified as Class V Underground Injection Wells for in-situ mineral processing and would be constructed using a similar design as the injection and extraction wells approved and installed for the HB Solar Solution Mine (see Section 2.4.2.1 of the HB EIS). The following figures illustrate the injection and extraction well design:

- **Figure EA-2 – Injection Well General Design**
- **Figure EA-3 – Extraction Well General Design**

Proposed wells IP-301 and IP-302 may require modifications to the drilling and well completion design based on the occurrence and condition of the 3<sup>rd</sup> Ore Zone as drilling passes through it. BLM would be notified of any modification to an approved plan prior to construction.

### **Injection and Extraction Well Access and Drill Pads**

Access routes to the injection and extraction well locations shall be via the pipeline routes, which include an inspection/maintenance road within the utility corridor. The drill pad would be cleared and grubbed of vegetation and graded to facilitate well installation. Cleared vegetation would be randomly scattered outside the drill pad and not left in piles or rows. The disturbance area would be graded to the degree necessary to allow drilling and well construction activities. In the event that graded surface materials cannot support drilling and support equipment, a lift of caliche may be applied. The caliche would be supplied by an area contractor/supplier from sources controlled by that contractor.

The drill pad and associated disturbance area would be 150 ft by 250 ft and would contain all drilling equipment, drilling material storage, subcontracted services such as drilling fluid supply and delivery, cementing, casing installation, geophysical logging, fueling, etc. The site would contain bermed and lined pits, tanks, and other components to manage drill cuttings and drilling fluids. The sites would also be bermed and equipped with straw booms on the down-slope edges to serve as secondary containment. All fuels and lubricants would be contained in secondary containment facilities. The location would contain portable sanitary facilities, office/maintenance trailers, and light plants.

Once drilling activities are complete, all well construction equipment, left over materials, and waste would be removed from the site. Following well head construction associated with the surface control facilities, which would be contained within an 80-ft by 80-ft fenced area within the drill pad, the well pad would be graded and seeded with a seed/fertilizer mix as specified by the BLM. If caliche was used to stabilize the pad, all caliche would be removed from the site prior to reclamation.

**Figure EA-4 – General Drill Pad Layout** illustrates the drill pad configuration for the injection and extraction wells. Drilling and well construction would be performed on a 24/7 shift rotation, unless hours are restricted due to lesser prairie-chicken habitat. All pad, drilling and well construction activities would be overseen and directed by qualified personnel. The technical site representative would be responsible for all decisions regarding drill depths and well completion details.

## Well Head Infrastructure

Each of the four well locations would be equipped with operating infrastructure to facilitate brine injection and extraction as follows:

- Well head manifold and valving.
- Power transformation and motor control components.
- Well head security and fencing.
- Down-hole equipment.

All four well head areas would utilize an 80 ft by 80 ft operational area for the life of the operation. All equipment would be contained within the 80 ft by 80 ft area. Any area within the 80 ft by 80 ft operating area that falls outside of concrete pad footprints would feature a gravel base and be fenced with a 4-strand wire fence with access gates as per BLM stipulations.

The working area would contain various electrical cabinets for instrumentation, motor control/variable frequency drive, and power transformation/distribution mounted on concrete pads. Manifold piping inclusive of various vents, valves, sample ports, and instrumentation would be connected from the well to the distribution piping via flanged fittings to facilitate future maintenance.

The operational area would also include telemetry and distributed control system equipment to transfer data and allow remote operation of the well site. The telemetry system is anticipated to consist of a radio-based network that would tie into the existing HB Solar Solution Mine telemetry system and would require small antennas at each of the well heads. Key control and instrumentation would include manifold and pipeline pressure monitoring, injection and extraction flow rates, mine flood level elevations, site security features, and various power parameters such as voltage, amperage, pump speed, etc.

The immediate area containing the extraction or injection well, the well head piping manifold, and the electrical cabinetry would be surrounded by a shaded, chain link fence with locking gates. Power would be brought to the site via overhead service terminating adjacent to the operating area. Power would be transformed to three phase 480 volt and then run underground to electrical transforming cabinetry within the operating area and distributed to various components within the operating area.

## Access, Piping and Roads

All new pipelines would be constructed with high density polyethylene (HDPE) Type PE 4710 pipe. The designed flow rates and maximum operating pressures determine the Standard Dimension Ratio (SDR), which is the ratio of pipe diameter to wall thickness for the pipe, to be selected for each pipeline. The lower the SDR, the higher the maximum operating pressure rating.

Injection brine would be transported from the northern extent of the existing HB Solar Solution Mine main trunk injection line to injection wells IP-301 and IP-303 (see Figure EA-2). Injection pipelines would be designed to convey up to 3,000 gpm within the pipelines rated operating pressure of 250 pounds per square inch (psi) for SDR-9 pipe. The injection pipelines would be constructed with extrusion welded and/or flanged 18-inch diameter Standard Dimension Ratio (SDR)-9 HDPE pipe PE 4710.

The pipeline would be equipped with manual isolation valving, vent and vacuum relief valves, and pressure monitoring points as needed to monitor brine flow, as part of the leak detection system. All injection lines would be buried with a minimum of 2 ft of fill over the pipe. During construction open trenches would be limited to ½ mile in length or escape ramps would be installed every ¼ mile. Once backfilled, a 6-inch to 12-inch mound would be left over the pipeline to allow for settlement. Blinded wyes would be installed approximately every 1,500 ft to provide access for maintenance. All pipeline access points for instrumentation, monitoring or control would be within vaults or small areas of pipeline surface exposure.

The injection line would cross State Trunk Highway (STH) 360 at one new location as shown in Figure EA-2. The STH 360 crossings would be facilitated by boring and jacking beneath the highway as described in Section 2.4.2.1 of the HB EIS. A New Mexico Department of Transportation (NMDOT) permit would be obtained for these crossings. The ROW area of construction disturbance would be 50-ft wide. Within the 50-ft ROW containing the buried pipeline, a 12-ft wide access road would be established to allow the pipeline to be inspected on a regular basis. The access road would also provide access for maintenance and routine monitoring of the instrumentation. **Figure EA-5 – Typical Pipeline ROW Section** illustrates the pipeline footprint. Upon completion of pipeline and access road construction all disturbance within the 50-ft ROW would be seeded, fertilized, and mulched as per BLM requirements and Conditions of Approval.

The brine extraction pipeline and associated dilution water line would be extended from the existing HB Solar Solution Mine pipeline network to each HB AMAX extraction well as detailed in Section 2.4.2.1 of the HB EIS. The extraction and dilution lines would be buried together for their entire length. The pipeline bundle would cross STH 360 at the location (see Figure EA-2) of the existing HB Solar Solution Mine injection line crossing in Section 33 to minimize disturbance areas.

The extraction pipeline has been designed to convey up to 2,000 gpm within the pipelines rated operating pressure of 200 PSI for SDR-11. The extraction line would consist of 12-inch and 16-inch diameter, SDR-11 HDPE pipe. The dilution line would be composed of 4-inch and 6-inch diameter SDR-9 HDPE pipe and has been designed to operate at a pressure of 250 PSI. The new pipelines installed as part of the proposed HB AMAX Solution Mine Extension Project would be buried with a minimum 2 ft of cover.

The pipeline leak detection system consists of routine inspections by Intrepid personnel to observe for potential pipeline leaks and monitoring with automated instrumentation to minimize the potential for unauthorized discharges of the transported brine.

## Booster Pump Station

Hydraulic analysis of the proposed HB AMAX injection pipelines indicates that a booster pump station would be required to achieve maximum desired flow rates within designed operating of the pipeline. Accordingly, a booster pump station is proposed to be installed where the new HB AMAX injection line connects to the existing HB Solar Solution Mine injection main trunk line. **Figure EA-6 – Booster Pump System Detail** illustrates the booster pump station location.

The pump station would require a graded footprint of 130 ft by 100 ft and would contain a primary pump, standby/back-up pump, a building to house the pumps, power transformation, and motor controls. The site would also include instrumentation, data acquisition, and automated controls connected by radio repeater to the adjacent HB Solar Solution Mine well facilities which would be routed to the HB control center.

The booster pump station is estimated to require 350 HP driven operations. Power would be supplied by the existing overhead power line to well IP-016. The booster station would be fenced with a 4-strand wire fence and access gates would be installed along the access pipeline roadway per BLM requirements. Figure EA-6 shows the booster station location, configuration, and how the maintenance access road would be constructed and maintained.

## Power Distribution

Power would be required at each of the four well sites and the booster pump station. Overhead power has been previously supplied to existing extraction well IP-016 by Xcel Energy. The same line that distributes power to IP-016 is routed immediately adjacent to the proposed booster station location. It is anticipated that Xcel Energy would be able to modify the existing power service to support the requirements at the booster station and the only new infrastructure required may be an additional pole and associated underground service from the pole to the booster station.

Central Valley Electric Cooperative (CVEC) operates an existing power line ROW located between Sections 4/5 and Sections 8 /9, T19S, R30E. New overhead power service is expected to proceed north from this existing ROW approximately ¼ mile to IP-303 along the proposed pipeline alignment and south from this existing ROW approximately ¾ mile to the south to IP-301. CVEC also operates an overhead power line in the middle of Section 11, T19S, R30E and another power ROW running immediately adjacent to IP-304. It is anticipated that the ROW adjacent in Section 11 would be extended approximately ¾ mile west to IP-302 and that the ROW to IP-304 would provide power directly to IP-304. Since the proposed power distribution is a connected action of the HB AMAX Solution Mine Extension Project, the environmental analysis for the proposed power distribution is contained in this EA.

Figure EA-5 illustrates the power ROWs and assumed distribution routes. The referenced power supply logistics above would be verified with Xcel Energy and CVEC.

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### **2.2.3. Final Restoration and Reclamation**

Construction and mitigation measures for the proposed project components would be the same as those as described in the HB In-situ Solution Mine Project documents, including:

- HB In-situ Project Mine Operations and Closure Plan, Revised March 9, 2012
- HB In-situ Project FEIS, January 2012
- HB Pipeline Right-of-Way Grant, Serial Number NM-121815, April 11, 2012
- HB In-Situ Solution Mine Project ROD, March 19, 2012

Restoration, reclamation, and financial assurance quantification of all HB Solar Solution Mine components used separately or in conjunction with the proposed HB AMAX Solution Mine Extension Project are specifically addressed in the NMED Discharge Permit Mine DP-1681 Modification submittal Discharge Permit Renewal Modification Request - HB Solar Solution Mine NMED DP-1681 – HB AMAX Extension dated February 12, 2015.

## **2.3. No Action**

The No Action Alternative would deny the approval of the proposed project and would not grant permission for Intrepid to access public lands in order to solution mine federal potash and associated minerals. Current land and resource used would continue under current conditions in the project area. As a result, BLM would not realize royalties from the extraction of federal potash from the proposed HB AMAX Solution Mine Extension Project. Also, a large erosional feature near IP-302 would not be stabilized and would continue to deteriorate.

## **2.4. Alternative Analyzed in Detail**

Intrepid developed an alternative pipeline layout with the goal of keeping the injection and extraction pipelines in the same ROW for as long as practicable to minimize environmental impacts. The drill pads, booster pump station, and power routes would remain as discussed in Proposed Action Section 2.1.

**Map EA-4 - Disturbance Areas along Proposed and Alternative Pipeline Routes** illustrates the proposed pipeline and alternative pipeline options and the locations of designated disturbed, undisturbed, and adjacent areas. The impact categories are defined as follows:

- Disturbed – pipeline would be within previously disturbed area (i.e., abandoned railroad grade)
- Undisturbed – pipeline would be located within an area that has not been previously disturbed

- Adjacent Area – pipeline would be located adjacent to a previously disturbed area which would consolidate the disturbance into one area or corridor. This is accounted for in this EA as a new disturbance on a previously undisturbed area.

The alternative pipeline option would utilize one trench to transport both the injection and extraction pipeline along the abandoned railroad grade to where the extraction and injection pipeline would split trenches in Section 15, T19S, R30E. The construction details and methods would be the same for the proposed pipeline option and the alternative pipeline option. The pipeline trench disturbance acreage for both pipeline options is represented in **Table 2.3-1 – Pipeline Disturbance Acreage During Construction**.

**Table 2.3-1 Pipeline Disturbance Acreage During Construction**

<b>Alternative Pipeline Option</b>	
<b>Description</b>	<b>Acres</b>
Disturbed Area (Non-Fee Area)	36.2
Disturbed Area (Fee)	7.0
Undisturbed Area (Non-Fee Area)	26.0
Undisturbed Area (Fee)	0
<b>Total Acreage</b>	<b>69.2</b>
<b>Proposed Pipeline Option</b>	
<b>Description</b>	<b>Acres</b>
Disturbed Area (Non-Fee Area)	33.7
Disturbed Area (Fee)	0
Immediately Adjacent to Disturbed Area	27.6
Undisturbed Area (Non-Fee Area)	17.3
Undisturbed Area (Fee)	0
<b>Total Acreage</b>	<b>78.5</b>
Total Length of Alternative Pipeline	111,100 linear ft.
Total Length of Proposed Pipeline	104,600 linear ft.

Note: Total pipeline length numbers are rounded to nearest 100 ft.

The alternative pipeline would utilize approximately 9.3 fewer acres than the proposed pipeline option, but would increase the total length of the pipeline by approximately 6,500 linear ft. The alternative pipeline option would run through 7.0 acres (of total ROW area) of private fee land. The proposed option would run through no private fee land.



### 3. ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

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The No Action Alternative reflects the current situation within the project area and will serve as the baseline for comparing the environmental impacts of the analyzed alternatives.

During the analysis process, the interdisciplinary team considered several resources and supplemental authorities. The interdisciplinary team determined that the resources discussed below would be affected by the proposed action.

#### 3.1. Geology and Minerals

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##### 3.1.1. Affected Environment

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###### Site Geology

The following section discusses pertinent geology at the project site starting with a brief introduction to the regional geologic setting, focusing on mineral resources, karst, subsidence, and paleontology.

###### *Regional Geologic Setting*

The regional geologic setting at the AMAX Mine is nearly identical to the geologic setting discussed in Section 3.2 of the HB EIS. The HB Solar Solution Mine and the HB AMAX Solution Mine Extension Project occurs at the northern edge of the Delaware Basin, extending north toward the Northwest Shelf (**Map EA-5 – Major Geologic Structural Elements**). The AMAX Mine is located closer to the basin edge (Northwest Shelf) than the HB Solar Solution Mine. Sedimentary deposits in the Delaware Basin are up to 30,000 ft thick and range in age from Cambrian to the Quaternary (Section 3.2.1 of the HB EIS, BLM 2012).

The Delaware basin is bound on four sides by topographic highs. The Northwest Shelf forms a northern boundary, the Central Basin Platform is to the east, the Glass and Apache Mountains are to the south, and the Diablo Platform and Guadalupe Mountains are to the west (Montgomery et al. 1999).

Locally, the structure can be controlled by salt flowage and dissolution. The plasticity of salt results in a flowage response to stress; this flowage can deform adjacent strata. Dissolution of evaporites and carbonates creates cavities with the potential for collapse of overlying strata; on a local scale these collapse features can dominate the geologic structure (Section 3.2.1.3 of the HB EIS, BLM 2012).

###### *Stratigraphy at Project Site*

A generalized stratigraphic column showing the geologic sequence in the northern Delaware Basin is shown in **Figure EA-7 – Delaware Basin Stratigraphic Column**. The depositional environments within this sequence reflect changes in the Delaware Sea water level and include continental, shallow marine, shelf, and basin. The sedimentary basin is underlain by Precambrian basement that includes granitic, meta-sedimentary and some volcanic rocks (Section 3.2.1.2 of the HB EIS, BLM 2012).

The potash mineral zone of interest for the HB Solar Solution Mine and the HB AMAX Solution Mine Extension Project is in late Permian Ochoan Series. This geologic discussion includes the formation directly underlying the ore zone and all overlying formations. A generalized cross section for the Delaware Basin is shown in **Figure EA-8 – Representative Cross Section**. The AMAX Mine is in the transition zone between the reef and the Northwestern Shelf.

The following sections outline the major geologic units at the project site. They have been divided by age and are presented from the older Permian units to the younger Quaternary units. Additional information on these units can be found in Section 3.2.1.3 of the HB EIS (BLM 2012).

## Permian Rocks

### *Guadalupian Series*

The upper Guadalupian Series has several time-equivalent members that vary based on the depositional environment. The Bell Canyon Formation is a sandstone, siltstone, limestone that was deposited in the deep basin beyond the reef (NPS 2008). The Capitan Limestone Formation is a reef complex that formed during the Permian and outlines the margin of the Delaware Basin (Standen et al. 2009). The sandstone, siltstone, and dolomite of the Yates and Tansill Formations were deposited in the back reef depositional environment (NPS 2008). Generalized stratigraphic columns showing the deep basin, reef, and back reef for the Delaware Basin can be seen in **Table 3.1-1 – Upper Guadalupian-Ochoan Stratigraphy in the Project Area, after BLM (2012)**; geology at the HB Solar Solution Mine and the HB AMAX Solution Mine Extension Project would be most similar to the “Shelf-Back Reef” column. The Figure EA-8 cross section shows the transition from the deep Delaware Basin to the Northwest Shelf.

**Table 3.1-1 Upper Guadalupian-Ochoan Stratigraphy in the Project Area, after BLM (2012)**

System	Series	South		Project Area	North	Approximate Thickness in Project Area (feet)	
		Delaware Basin			Northwest Shelf		
		Basin	Basin Margin – Reef		Shelf – Back Reef		
Permian	Ochoan	Dewey Lake Red Beds	Dewey Lake Red Beds		Dewey Lake Red Beds	Up to 250	
		Rustler Formation	Rustler Formation		Rustler Formation	Up to 350	
		Salado Formation	Salado Formation		Salado Formation	150 to 1,000	
		Castile Formation	Castile Formation		No equivalent	10 to 80	
	Guadalupian	Bell Canyon Formation	Capitan Limestone		Tansill Formation	1,500	
					Yates Formation		
					Seven Rivers		

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### *Castile Formation*

The Castile Formation is a predominantly anhydrite sequence with minor occurrences of limestone and halite (NPS 2008). The Castile Formation is thick in the deep basin, thins toward the reef, and is mostly absent in the back reef (Figure EA-8). If present within the proposed project area, the Castile Formation would only be a thin unit between the Guadalupian Series and the overlying Salado Formation.

### *Salado Formation*

The Salado Formation of the Ochoan Series directly overlies the Guadalupian Series. The Salado Formation is a thick, predominantly evaporite deposit containing the McNutt Potash Member of interest. This formation is 1000 ft thick at the mine site and dominated by halite with minor zones of siltstone, sandstone, anhydrite, gypsum, and potash minerals. The important economic potassium minerals in the McNutt Member are sylvite (KCl) and langbeinite ( $K_2Mg_2(SO_4)_3$ ) (Lambert 1983).

### *Rustler Formation*

The Rustler Formation overlies the Salado Formation and contains anhydrite, dolomite, siltstone, sandstone, and gypsum units. Members of the Rustler Formation from oldest to youngest are Los Medaños, Culebra Dolomite, Tamarisk, Magenta Dolomite, and Forty-Niner (Intrepid/Shaw 2008a).

The Los Medaños Member is composed of siltstone, gypsum, and fine-grained sandstone layers. The Culebra Dolomite is a thinly bedded, crystalline dolomite. The Tamarisk member is a massive anhydrite unit with minor halite and siltstone layers; when exposed in outcrops the Tamarisk weathers to gypsum. The Magenta dolomite is a pink, red, and purple dolomite. The Forty-Niner Formation has layers of gypsum, anhydrite, siltstone, shale, and clay (Section 3.2.1.3 of the HB EIS, BLM 2012).

### *Dewey Lake Formation/Quartermaster Formation*

The Dewey Lake Red Beds, also referred to as the Quartermaster Formation, mark the end of marine incursions into the basin and the beginning of continental deposition. This formation contains reddish-orange siltstone with some sandstone and clay layers (Vine 1963). The top of the Dewey Lake Formation is an erosional surface dividing the Permian from the overlying Triassic rocks (Lambert 1983).

### **Triassic Rocks**

Triassic strata in the project area include the Santa Rosa Formation (Tecolotito, Los Esteros, and Tres Lagunas Members) with limited occurrence of the Upper Chinle Group (Garita, Trujillo, Bull Canyon, and Redonda Formations). The Santa Rosa Formation is an orange, red, yellow, purple, and grey sandstone with interbedded siltstones and occasional calcareous units. The Upper Chinle Group is a mix of mudstone, siltstone, and sandstone dominated sequences (Lucas et al. 2001).

### **Cenozoic Rocks**

Several Cenozoic units are present at the HB Solar Solution Mine and the HB AMAX Solution Mine Extension Project site. These units are generally not as widespread as the underlying strata. The Gatuña Formation is a late Cenozoic, poorly consolidated alluvial formation in the ancestral Pecos River valley (Lambert 1983). This formation is dominated by sand and locally contains mudstone, conglomerate, limestone, gray shale and gypsum (Kelley 1980). Near Carlsbad the Gatuña is typically buried by more recent floodplain, terrace, caliche or aeolian deposits (Kelley 1980) including the Mescalero Caliche and unconsolidated materials. The Mescalero Caliche is a dense to travertine-like limestone with intermixed sand grains (Vine 1963). Unconsolidated Quaternary material includes alluvial, eolian, and lacustrine deposits.

### **Surficial Geology**

The surficial geology within the project boundary is shown in **Map EA-6 - Surficial Geology Map**. It includes outcrops of the Rustler Formation, Quartermaster Formation (Dewey Lake Formation), Upper Chinle Group, and unconsolidated quaternary deposits. The Rustler and Quartermaster Formations outcrop along the edges of the project site. The Upper Chinle Group is exposed at the center of the project site. The remainder of the project site is mapped as unconsolidated quaternary deposits.

## **Mineral Resources**

### Potash

The history of potash mining was discussed in detail in Section 3.2.2.1 of the HB EIS (BLM 2012). Potash was discovered in Eddy County, New Mexico in 1925 during oil and gas exploration. The federal government designated the SPA in 1939 (BLM 2014c). Mining has occurred in the McNutt potash zone of the Salado Formation and this zone contains the potash minerals of interest to this project. There are 11 ore zones in the McNutt potash zone (Barker and Austin 1993). Today, two companies, Intrepid and Mosaic, operate underground potash mines in the SPA (USGS 2009). Intrepid operates the only solution mine in the SPA.

Conventional mining in the SPA is done by sinking shafts from the land surface to the mineral zone of interest and excavating ore using a room and pillar method. Large pillars of ore are left in the mine for support of the

overlying strata. Once excavated, the ore is transported to the land surface and refined. The room and pillar method leaves behind ore in the pillars, walls and floors (Section 3.2.2.1 of the HB EIS, BLM 2012).

Recently, solution mining has been used in idled potash mines as a means of recovering ore that was unrecoverable using conventional mining methods. The HB Solar Solution Mine uses this method, and approval of the HB AMAX Solution Mine Extension Project would provide access to more mine workings for flooding and extraction. During solution mining, the idled underground mine workings are flooded with injectate brine. The remaining ore is selectively dissolved into the brine and the resulting pregnant brine is pumped out of the mine using extraction wells.

#### Oil and Gas

The history of oil and gas development in the Delaware Basin was discussed in detail in Section 3.2.2.2 of the HB EIS (BLM 2012). The Delaware Basin is part of the prolific Permian Basin oil and gas reserves. As of 2000, oil plays in the New Mexico portion of the Permian Basin have produced 4.5 billion barrels of oil; most of this production has occurred on the Northwest Shelf and Central Platform (Broadhead et al. 2004).

Production and exploration are ongoing. Untapped oil and gas resources from known existing plays in the SPA are estimated at 468 million barrels of oil and 5.5 trillion cubic ft of natural gas (Balch et al. 2011). Target formations for commercially producible hydrocarbons in the SPA include the Pennsylvanian (Morrow, Atoka, and Strawn Formations) and Permian (Delaware Mountain Group, Bone Spring Formation, Wolfcamp Group, Queen Formation, Grayburg, Formation, Seven Rivers Formation, and Yates Formation) (Walsh 2006). Petroleum targets are below the McNutt potash zone of the Salado Formation. The Delaware Mountain Group is the shallowest petroleum target. When present, the Castile Formation separates the Delaware Mountain Group from the potash bearing Salado Formation.

Relevant policies addressing potential conflicts between the production of oil and gas and the extraction of potash were discussed in Section 3.2.2.3 of the HB EIS (BLM 2012).

The area around the HB Solar Solution Mine and HB AMAX Solution Mine Extension Project has been involved with historical petroleum exploration and development since the 1930s. As such, active and inactive oil wells within the proposed project area have been researched and documented. There are 67 oil and gas wells within the project boundary, including abandoned and active wells, which are shown in **Map EA-7 - Oil and Gas Wells**. Of these 67 wells, three wells are within the proposed flood zone in the AMAX Mine working, two wells are less than 100 ft from the flood zone, and one well is within 1,000 ft from the flood zone.

The six wells within or near the flood zone are summarized in **Table 3.1-2 – Abandoned Oil Wells Within the AMAX Mine Flood Workings**. All six of these wells have been plugged, as of April 2015, using BLM approved plugging practices. (Intrepid Potash Inc./Foth 2015). Intrepid plugged wells 30015045970000, 30015045990000, and 30015046000000 in 2015.

#### Other Minerals

Other minerals being mined in Eddy County, New Mexico include sand and gravel, crushed stone, salt, and sulfur (USGS 2009).

**Table 3.1-2 Abandoned Oil Wells Within the AMAX Mine Flood Workings**

API/UWI	Operator	Name	Status	TD	Spud Date	Completed	Plug Date	Distance from Flood Zone	Location (Township – Range – Section)
30015045900000 <sup>1</sup>	Baird, O J	Cannon	Plugged <sup>2</sup>	3,205	9/19/1938	3/19/1939	7/29/1940	Within	T19S – R30E – Sec. 4
30015045900001 <sup>1</sup>	Elliott, James	Cannon	Plugged <sup>2</sup>	3,660	7/15/1939		7/29/1940	Within	T19S – R30E – Sec. 4
30015045950000	Yates, Harvey	Foard	Plugged	2,990	10/26/1943	1943	1/10/1944	Within	T19S – R30E – Sec. 10
30015045980000	Southwestern Inc.	Southern Cal-Fed	Plugged	2,203	8/22/1960	9/9/1960	2/26/1961	690 ft	T19S – R30E – Sec. 13
30015045970000	Culbertson, E A & WW	Federal 13	Plugged <sup>3</sup>	2,216	10/25/1960	11/13/1960	2015	Within	T19S – R30E – Sec. 13
30015045990000	Culbertson, E A & WW	Federal 13	Plugged <sup>3</sup>	2,321	2/2/1961	2/20/1961	2015	83 ft	T19S – R30E – Sec. 13
30015046000000	Southwestern Inc.	Southern Cal-Fed	Plugged <sup>3</sup>	2,181	5/15/1960	6/2/1960	2015	20 ft	T19S – R30E – Sec. 14

**Notes:**

<sup>1</sup> Wells 30015045900000 and 30015045900001 are the same well head; the latter was a deepening of the initial well.

<sup>2</sup> Plugged based on BLM Memorandum (dated February 24, 1941) and field verification of dry abandonment well marker

<sup>3</sup> Plugged by Intrepid in 2015. Plugging was approved by the BLM.

API: American Petroleum Institute

TD: Total Depth

UWI: Unique Well Identification

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Checked By: BAL3

## Subsidence

Subsidence is the gradual settling or sudden sinking of the ground surface resulting from extraction, dissolution, or consolidation of subsurface materials. Subsidence can be natural or anthropogenic in origin. Karst is a natural landscape shaped by the dissolution of carbonate and evaporite bedrock. Caves and sinkholes are two common karst features. Human activities that can contribute to or cause subsidence include underground mining, the withdrawal of subsurface fluids, and the addition of weight, such as roads and buildings, to the land surface (CGS Undated).

### Cave and Karst

Karst topography, resulting mostly from the dissolution of carbonates and evaporites, is widespread in the Delaware Basin. Dissolution is common in the Capitan Limestone and in the evaporite deposits. Karst terrain is expressed as a rolling landscape caused by slow dissolution and may have collapse sinkholes from sudden failure of the ground surface into an underground cavity (Hill 2000). Karst features explain the numerous closed basin watersheds found in the project area.

Karst allows for rapid recharge of aquifers and transmission of groundwater. Groundwater causes continued dissolution of soluble rock and expansion of karst features. Water is also critical to the highly specialized cave-dwelling animals that may inhabit caves (Section 3.2.3.1 of the HB EIS, BLM 2012)

More than 60 caves and karst features within the project boundary have been identified from the BLM karst dataset (Goodbar 2015). The BLM also has a cave/karst potential rating system. **Map EA-8 - Karst Occurrence Potential** shows the distribution of karst potential within the proposed project boundary. The majority, 92.5 percent (%) of the project area is rated as having high karst potential. The rest of the project area, 7.5%, has a medium karst potential rating.

### ***Anthropogenic Subsidence***

In the Delaware Basin, anthropogenic subsidence is mainly caused by potash mining and fluid extraction of petroleum products and water.

#### **Potash Mining**

Mining subsidence occurs when the rock and soil around a mined cavity deform in an effort to reach a new equilibrium position. In room and pillar mining, rooms are void spaces where ore has been removed and pillars are the remaining ore that is left in place to prevent closure. Subsidence within the mine can occur when overlying or adjacent materials deform in toward the mine rooms. On the land surface this deformation can manifest as surface cracking, ground deformation, and the modification of surface water drainages. The aerial extent of subsidence often extends beyond the mine workings and is controlled by the angle of influence (Section 3.2.3.1 of the HB EIS, BLM 2012).

#### **Solution Halite Mining**

Brine wells are used to solution mine halite in the Delaware Basin. Freshwater is pumped into the brine well and then brine is pumped out. The extracted brine is used for oil and gas development. This extraction method has the potential to cause rapid subsidence; two such collapse sinkholes occurred in 2008 near brine wells located outside of Carlsbad, New Mexico (Oil Conservation District 2011).

#### **Subsidence Related to Oil and Gas Extraction**

Subsidence from petroleum extraction can result from dissolution of salt either by drilling fluids during construction of the well or by formation fluids moving along a poorly cemented casing. Without adequate cement the annular space between the casing and borehole wall can act as a preferential pathway for formation water to move up and down the borehole. This pathway could transport groundwater to an evaporite zone, resulting in dissolution and subsequent subsidence (Section 3.2.3.1 of the HB EIS, BLM 2012). Petroleum wells in the Permian Basin were cased, but not necessarily cemented, until the 1930s; cement was not required in the salt formations until the 1950s and early cement techniques were often poor (Giroux et al. 1988). Cementing methodology has improved with time. Current well construction requires cement throughout the whole salt interval, greatly reducing the potential for salt dissolution in

modern oil and gas wells. However, even in properly cemented wells, the brines can deteriorate the cement and compromise the seal (Section 3.2.3.1 of the HB EIS, BLM 2012). The extraction of fluids can also cause subsidence from the collapse of pore spaces and reorganization of the rock matrix.

## Paleontology

Scientifically important paleontological resources are federally protected under the Antiquities Act of 1906, the Archaeological and Paleontological Salvage Act, and the National Registry of Natural Landmarks (BLM 2012). In addition to internal guidelines on managing paleontological resources, the BLM has identified following applicable statutes and regulations (BLM Undated):

- FLPMA of 1976
- NEPA of 1969
- BLM regulations in Title 43 CFR addressing invertebrate and plant fossils
- The Paleontological Resources Preservation Act of March 2009
- 43 CFR Subpart 3622 – Free Use of Petrified Wood

The BLM has adopted a Potential Fossil Yield Classification (PFYC) as a quick reference for assessing possible fossil resources on BLM land (BLM 2007a). This classification system uses the surficial geology as a predictor for fossil potential. The purpose of this classification system is to serve as a guideline for determining the need for further mitigation or actions. The classification system has five classes (1-5); Class 1 has a low potential for scientifically important fossils while Class 5 has a high potential. Each class includes an associated response.

The surficial geology and associated paleontological classes within the project boundary are summarized in **Table 3.1-3 – Potential Fossil Yield Classes for Surficial Geologic Units in the Project Boundary** and shown in **Map EA-9 - Paleontology Map**. **Table 3.1-4 – Total Area of each Potential Fossil Yield Class in the Project Boundary** tabulates the acres for each PFYC in the project boundary.

**Table 3.1-3 Potential Fossil Yield Classes for Surficial Geologic Units in the Project Boundary**

Surficial Geologic Unit	Description of Paleontological Resources <sup>1</sup>	Fossil Potential Class from PFYC
Alluvial and Eolian Deposits	Because such deposits are younger than 10,000 years old, there would be a low potential for fossils.	Class 2 – Low potential for vertebrate fossils or scientifically important nonvertebrate fossils.
Cave Deposits (possible)	Cave deposits (Pleistocene to recent) can host a variety of vertebrate fossils	Class 4 – High potential for scientifically important fossils
Rustler Formation	Fossils in the Rustler Formation are scarce; there are mollusk fossils in the Culebra Member of the Rustler Formation	Class 2/3 – Low/Moderate potential for scientifically important fossils. Class 3 is only applicable to the Culebra Member. The remaining members of the formation would be considered Class 2.
Quartermaster (Dewey Lake Red Beds)	No fossils identified in the literature.	Class 2 – Low potential for scientifically important fossils
Upper Chinle Group	Vertebrate fossils, tetrapod footprints, and megafossils plants have been found in these formations (Lucas et al. 2001).	Class 4 – High potential for scientifically important fossils

Notes:

<sup>1</sup> The description of fossil resources came from Section 3.2.4.2 of the HB EIS (BLM 2012), unless otherwise specified.

Prepared By: MJH5  
Checked By: BAL3

**Table 3.1-4 Total Area of each Potential Fossil Yield Class in the Project Boundary**

<b>PYFC</b>	<b>Acres</b>	<b>Percentage of Total Area</b>
Class 2	10,149	55%
Class 2/3	6,270	34%
Class 4	1,928	11%
<b>Total</b>	<b>18,347</b>	<b>100%</b>

Notes:

1. Areas were calculated in ArcGIS using the surficial geology layer provided by the BLM.
2. Areas were rounded up to the nearest tenth of an acre.

Prepared By: MJH5

Checked By: BAL3

An outcrop survey was conducted on February 1, 2015 by a licensed paleontology contractor at Zeigler Geologic Consulting, LLC. The purpose of this survey was to look for potential fossil resources that may be impacted during ground disturbing activities related to the proposed project. The survey covered a 150-ft corridor on either side of the pipeline centerline stake and all well pads. No fossil material PFYC Classes 3 or 4 was found. The majority of outcrop and subcrop through these areas was gypsiferous, which would not preserve invertebrate or vertebrate fossil material. There is a low siltstone and sandstone bluff leading to well pad IP-304 that could contain fossil material.

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### ***3.1.2. Impacts from the No Action Alternative***

#### **Direct and Indirect Impacts**

##### ***Mineral Resources***

Under the No Action Alternative the remaining potash resources in the AMAX Mine would not be recovered. This would result in a loss of recoverable resource, revenues, taxes, and royalties. The resource is inaccessible under conventional mining techniques and would remain unmined unless some other practical method could be found to extract the resource safely.

Impacts to petroleum development would be identical under the No Action Alternative. The location of new wells would continue to be limited by a designated buffer zone around the existing AMAX Mine workings, regardless of whether or not solution mining occurs. Such a buffer zone is defined and discussed in 2012 Secretary's Order. Impacts from poorly cased oil and gas wells and improperly abandoned wells would not affect potash mining if solution mining did not occur.

##### ***Karst Resources***

Karst resources would not be affected under the No Action Alternative. Karst features that are actively forming would continue to do so, unless hydrologic conditions become unfavorable. Caves may be subject to degradation by entry of unpermitted spelunkers. Unpermitted entries are expected to be infrequent with BLM maintenance of cave lists and caves locations not accessible to the general public. Fluid and solid mineral extraction activities would likely continue in the vicinity and would be regulated by the BLM to reduce impacts to karst.

##### ***Subsidence***

Under the No Action Alternative subsidence would continue to pose a risk to surface resources. Naturally occurring evaporite karst features would continue to develop and existing features would be a risk for surface infrastructure. Subsidence from conventional underground mining at the AMAX Mine may continue indefinitely. Both historic data and anecdotal evidence suggest that for southeastern New Mexico potash mines, the majority of subsidence occurs within 5 to 7 years after completion of second mining of the ore pillars (Section 4.2.5.1 of the HB EIS, BLM 2012). Underground mining at the AMAX



Mine ended in 1993; the majority of subsidence for the HB AMAX Solution Mine Extension Project has likely already occurred with minor subsidence ongoing as a new equilibrium is achieved underground. The salt creep process is likely ongoing.

### ***Paleontology***

Under the No Action Alternative there would be no potential fossil damage from burying the pipeline and from the construction of well pads. Unauthorized collection of fossils could still occur.

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## ***3.1.3. Impacts from the Proposed Action***

### **Direct and Indirect Impacts**

#### ***Mineral Resources***

Regarding impacts to mineral resources, the Proposed Action has the beneficial impact of additional ore recovery. There are no mineral resource impacts specifically related to the construction phase of the Proposed Action.

The Proposed Action utilizes an existing underground mine that is already a restricted area for new oil and gas development. As such, there would be no change to access for oil and gas development and exploration. New oil and gas wells must maintain a buffer from the open mine workings, as defined and discussed in the 2012 Secretary's Order. All wells in or near the flood zone are plugged and abandoned using BLM approved plugging methods (Table 3.1-2). The closest oil or gas well that is not abandoned is UWI 30015355250000, located 1,521 ft north of the flood zone.

The Proposed Action could impact the nearby HB North Mine if a connection formed where the mine workings are within proximity to the AMAX Mine workings between Sections 16 and 21 and 21 and 22. See, **Map EA-10 - Structure on the Base of First Ore Zone**. The potential for accidental flooding of the HB North Mine is reduced by structural and mechanical controls on the flooding process. Locally, the ore structure forms a syncline with a southwest – northeast axis running down the approximate middle of the AMAX Mine ore bodies. The syncline axis represents a structural control which, if not over-topped, would prevent brines from migrating south into the adjacent HB North Mine. The maximum flood elevation would be set at 2,500 ft above mean sea level (amsl); the lowest elevation where a potential connection could develop is around 2,550 ft amsl. To avoid and minimize the potential for an unplanned flood, monitoring is discussed in the mitigation section below.

Based on the structural geometry brine cannot spill into the HB North workings as long as the flood elevation is not exceeded. In the unlikely event that brine from the AMAX Mine did enter the HB North Mine, the fluid would eventually find its way to the HB North extraction wells and be controlled via the existing HB Solar Solution Mine system.

#### ***Karst Resources***

The primary direct impacts to cave/karst resources under the Proposed Action include disturbance during pipeline burial, power line installation, and well pad construction. The pipeline route and power line corridors for the Proposed Action have at least a 200 meter buffer around all known cave features identified by the BLM. Ground disturbing activities during the construction phase still have the potential to damage unknown karst features.

Other potential adverse impacts to caves and karst features from construction include the following:

- New access roads in the project area could increase the opportunity for public entry and disturbance or damage to cave resources.

- Drill holes for the injection and extraction wells may intersect an undocumented cave/karst feature, allowing drilling fluids and mud to enter the cavity. This could affect groundwater and dissolve evaporite strata. Such an incident could pose risks to groundwater quality, health and safety, roads, and structures.
- If construction and drilling operation occur over an undocumented cave/karst feature there is the potential to cause a collapse sinkhole. Such an event would impact the karst landscape, may injure personnel, and could damage equipment.

Karst impacts from pumping injectate make-up water out of the Rustler Formation were explored in detail in the EIS. Two groundwater models (Preferred and Enhanced) were developed to support Section 4.3 of the HB EIS and used to assess the potential impacts of drawdown on karst. More details on the design and applicability of these two models are provided in the Water Resources Section 3.2 of this EA.

Under the Proposed Action the groundwater pumping rates for the Rustler Aquifer wells would be the same those presented in the EIS but pumping duration would increase. Because the original groundwater models were run in steady state, a longer pumping duration would not change the drawdown prediction, as discussed in Section 3.2. The number of caves and acreage for each karst potential affected by groundwater pumping (**Table 3.1-5 – Caves and Karst Features Affected by Groundwater Drawdown Under the Proposed Action**) were estimated for Section 4.2.6 of the HB EIS using the Preferred and Enhanced models.

**Table 3.1-5 Caves and Karst Features Affected by Groundwater Drawdown Under the Proposed Action**

<b>Features Affected by Drawdown</b>	<b>Impacts (Preferred Groundwater Model)</b>	<b>Impacts (Enhanced Groundwater Model)</b>
Known Caves (number)	18	38
High Cave/Karst Potential Area (acres)	10,977	23,961
Medium Cave/Karst Potential Area (acres)	2,949	5,832
Low Cave/Karst Potential Area (acres)	1,537	1,921

Notes:

1. All data are from the EIS (BLM 2012).

2. The number of caves and acres impacted were calculated by determining the quantity of caves and karst areas that would no longer have a groundwater table within 90 ft of the ground surface.

Prepared By: MJH5

Checked By: BAL3

Predicted karst impacts do not increase by adding the Proposed Action but the longer pumping duration may change the actual observed impacts to caves and karst, depending on if and when steady state is reached. It is unlikely impacts would ever exceed the total predicted impacts presented in the EIS because the groundwater model utilized a worst-case scenario and conservative assumptions. The original HB Solar Solution Mine EIS analyzed pumping for 28 years; the Proposed Action adds 14 additional years of pumping for a total of 42 years. If the steady state drawdown predicted by the groundwater models is reached before year 28, drawdown magnitude and extent would theoretically remain constant in perpetuity. At a constant drawdown, the additional impacts to caves and karst from extended pumping during years 28-42 is inconsequential; caves that were dry would continue to be dry and no new caves would go dry.

If maximum steady state drawdown was not reached by year 28, drawdown could continue to increase from years 28-42, up to the maximum drawdown predicted by the groundwater models. In this scenario more caves and karst areas could continue to go dry from years 28-42, up to the maximum predicted number. Therefore, if drawdown has not reached steady state by year 28, additional caves could be adversely affected by the Proposed Action that would not have been affected under the HB Solar Solution Mine. These potential impacts were discussed and accounted for in the EIS. If drawdown were to exceed

the steady state model predictions there would be additional habitat loss, beyond that predicted in the HB EIS, for the troglobitic species utilizing these cave habitats. To avoid and minimize the potential for these impacts, ongoing monitoring and adaptive management is discussed below in the mitigation section.

## ***Subsidence***

The Proposed Action has the potential to increase anthropogenic subsidence by solution mining the pillars in the AMAX Mine. The following paragraphs describe in detail how mining subsidence has occurred and may occur in the future for both traditional mining and solution mining.

### *Predicted Subsidence Effects Associated With Conventional Underground Mining*

The surface effects from the collapse of room-and-pillar workings depend on the depth, width, and thickness of the minerals extracted, the extraction ratio, and the extent of area over which underground pillar failure takes place. The maximum subsidence cannot exceed the mined thickness (Van Sambeek 2008). Maximum subsidence depth is seldom observed, due to one or more of the following reasons (Section 4.2.5.1 of the HB EIS, BLM 2012):

- Subsidence spreads over an area that is larger than the mined area, so the depth of subsidence is proportionately less than the total mined area.
- Total closure of the mined area is rarely reached. Remaining voids reduce the amount of subsidence.
- The overlying rock strata expand slightly in volume due to breakage as the ground moves downward into the mined area, resulting in a “bulking” effect, which contributes to a reduction in total subsidence volume and depth.
- The subsidence process can be slow for rocks that creep and several hundred (or more) years may be required for complete subsidence to occur.

Historic data and anecdotal evidence suggest that for the southeastern New Mexico potash mines, the majority of subsidence occurs within 5 to 7 years after completion of second mining of the pillars (Intrepid Potash Inc./Shaw 2008b). Because potash and other salts can creep, minor subsidence may continue to occur over an extended period of time.

Historic data and observations of subsidence in the potash areas of southeast New Mexico have demonstrated that the relationship between the extent of vertical surface subsidence and the thickness of the mining horizon varies with the degree of extraction. For full extraction (100%) of the mineable zone, it is likely that the maximum surface subsidence would approach the thickness of the mined zone. This is due to evidence suggesting very little breakup and bulking during collapse of the overlying strata (Section 4.2.5.1 of the HB EIS, BLM 2012). For extraction of less than 100%, the expected subsidence can be assessed using the mine height and data from mines in the area.

The AMAX Mine targeted the 1st and 3rd Ore Zones with the majority of ore produced from the 1st Ore Zone. Due to variations in thickness of the overlying formations and the dip of the beds, the depth to the ore zones from the ground surface is variable. The 1st Ore Zone can occur from about 816 ft to 1,042 ft below the ground surface and the 3rd Ore Zone can occur from about 787 ft to 1,027 ft below the ground surface. At the AMAX Mine, the 1st Ore Zone was extracted with an average mine height of 5.6 ft; the average mine height for the 3rd Ore Zone was 4.8 ft (Intrepid Potash Inc./Foth 2015).

During the period when the AMAX Mine was operational, an estimated 69% of the 3rd Ore Zone reserve and 85% of the 1st Ore Zone reserve was extracted (Intrepid Potash Inc./Foth 2015). This extraction was accomplished through first and second mining. During first mining, removal of ore typically results in a corresponding decrease in the available cross-sectional area remaining to support the overlying rock and an

increase in the magnitude of vertical stress on the ore in the remaining pillars. The increase in vertical stress is offset by the plastic nature of the salt (i.e., the salt adjusts for the change in stress through very slow, flow-like movements) and through redistribution of the stresses to the edges (the surrounding intact rock) of the mine workings. This pressure redistribution is referred to as “arch action” (Section 4.2.5.1 of the HB EIS, BLM 2012).

Second mining of pillars was typically accomplished by taking perpendicular cuts through the center of the pillars, leaving four corners of each pillar for support. The pillar remnants may be insufficient to support the overlying ground because the stress must be carried over a reduced cross-sectional area. Pillar failure usually occurs within about a month after “second” mining is completed (Intrepid Potash, Inc./Shaw 2008b). The residual corner pillars typically compress or crush due to the increased vertical stress from the overlying rock, eventually sloughing or spalling off at the midriff of the pillar to form an hour-glass shape. The sloughing and spalling action causes debris to accumulate on the floor surrounding the pillar. In the advanced stages of compressive action (as closure or full convergence of the mining void is approached), the roof may receive some support from the debris pile or underground backfilling from non-economic material within mined-out areas, ultimately delaying or precluding full convergence in a localized area of the mine (Section 4.2.5.1 of the HB EIS, BLM 2012).

Several subsidence studies were conducted in the late 1950s by United States Potash. Findings from these studies suggest that first mining ore removal had the potential to influence the surface at about 20% of the mined height, with second mining contributing an additional 50% of the mined height (Intrepid Potash, Inc./Shaw 2008c). Thus, the total surface expression of subsidence due to conventional first and second mining at the AMAX Mine is estimated at:

- 3.9 ft of subsidence for the 1st Ore Zone, calculated as  $[0.2 \times 5.6 \text{ ft}] + [0.5 \times 5.6 \text{ ft}]$
- 3.4 ft of subsidence for the 3rd Ore Zone, calculated as  $[0.2 \times 4.8 \text{ ft}] + [0.5 \times 4.8 \text{ ft}]$
- 7.3 ft of subsidence in areas where the 1st and 3rd Ore Zones were both mined, calculated as  $[3.9 \text{ ft} + 3.4 \text{ ft}]$

#### *Predicted Subsidence Effects Associated With Proposed Solution Mining*

Subsidence from solution mining is possible through removal of support material and expansion of the mine cavity. It is generally thought that solution mining does not drastically enlarge the mine cavity. Solution mining of potash ore at the former Texas Gulf Mine (now owned and operated by Intrepid) in Moab, Utah has shown no evidence of active dissolution occurring in ore beyond the original workings (Section 4.2.5.1 of the HB EIS, BLM 2012). The in-situ solution mining process would solubilize ore from exposed remnant pillars and debris piles, with a lesser contribution expected from wall and floor rock. Wall and floor rock typically define the transition or contact zone between the ore and surrounding host rock. Therefore, subsidence from solution mining would depend on the extent to which support material is removed. There is some control in the in situ process because the injectate is conditioned to selectively dissolve KCl through an ion exchange process. It is anticipated that a replacement lattice of NaCl would remain within the residual contact zone. Thus, the volume of NaCl precipitated correspondingly “reduces the potential for convergence and surface subsidence volume” (Van Sambeek 2008). The remaining NaCl in non-collapsed residual pillars or debris piles would not dissolve and would continue to provide support.

It was estimated for the HB solution mines that the in-situ process may cause surface subsidence equal to 10% of the overall mined height (Intrepid Potash Inc./Shaw 2008a). Applying this estimate to the AMAX Mine predicts a nominal 0.6 ft (1st Ore Zone) and 0.5 ft (3rd Ore Zone) of additional subsidence at the surface from solution mining. In areas where the mine working for the 3rd and 1st Ore Zones overlap, a combined maximum subsidence of 1.1 ft (0.6 ft + 0.5 ft) is possible. The predicted overall maximum surface subsidence expression, from both conventional and solution mining, is estimated as:

- 4.5 ft of subsidence for the 1st Ore Zone, calculated as [3.9 ft (conventional mining) + 0.6 ft (solution mining)]
- 3.9 ft of subsidence for the 3rd Ore Zone, calculated as [3.4 ft (conventional mining) + 0.5 ft (solution mining)]
- 8.4 ft of subsidence in areas where the 1st and 3rd Ore Zones were both mined, calculated as [3.9 ft + 4.5 ft]

In addition to subsidence impacts resulting from the conventional and solution mining, the additional weight from construction equipment could contribute to rapid collapse of unknown existing shallow subsurface cavities.

#### *Impacts from Subsidence*

Much of the subsidence due to conventional mining has likely occurred already. Due to the widespread areal distribution of the proposed in-situ process throughout the project area, the additional 0.5 – 1.1 ft of subsidence from solution mining would likely manifest itself very gradually over a number of years. It is anticipated that such gradual deformation would result in the development of wide-area, gentle depressions rather than localized, abrupt changes in the ground surface.

Subsidence has been monitored during the operation of Intrepid's nearby HB solution mines through a network of subsidence monitoring monuments installed in 2009 (**Map EA-11 - Subsidence Monitoring Transects**). The elevation of these monuments is surveyed quarterly to assess changes in the ground surface elevation. The maximum difference between the January 2014 monument elevations and the 2009 starting elevations, as of January 21, 2014 is 0.2 ft. Most monuments show no trend in elevation; some quarter's exhibit monument elevations that are higher than the 2009 reference data point and some are lower. No discernable trends are apparent based on the data collected to date. This lack of trends suggests that the elevation differences observed may reflect measurement limitations more than actual changes in ground elevation. Therefore, to date, subsidence impacts from operation of the HB Solar Solution Mine have been minimal.

Potential direct impacts from subsidence include pushed up well casings, damaged or failed well casings, cracking and fissuring of the ground, damaged or broken pipelines, and damaged buried utilities (Galloway et al. 2008). Sudden collapse without obvious warning may occur and potentially damage surface infrastructure. Indirect effects include alteration of surface drainages commonly resulting in impoundment of runoff or "sinking streams," disruption of shallow water tables, livestock or wildlife loss, and public safety hazard. Components of the Proposed Action most at risk are facilities such as wells, pipelines, and roads. Damage to surficial infrastructure is primarily caused by sudden, localized subsidence and any subsidence expected from solution mining is expected to be gradual, extending over a large area of gentle deformation.

Continued monitoring and evaluation of the existing subsidence monitoring network is planned to document potential surficial effects as discussed in the mitigation section below.

#### ***Paleontology***

Based on the paleontology survey results included in Appendix B there is generally low risk for adverse impacts to fossils because of the low potential for the occurrence of scientifically important fossils. The siltstone and sandstone bluff leading to well pad IP-304 was identified as potentially fossil-bearing and may have a greater risk for impacts.

## Mitigation Measures

Throughout the construction and operation of the Proposed Action several design features and best management practices would be utilized to minimize impacts to geological and mineral resources as described in Sections 2.1 and 2.2 of this EA. Additional mitigation measures recommended include the following:

- Monitoring data described in Sections 2.1 and Section 2.2, such as flow rates and mine flood level elevations, would be used to develop working-specific time/elevation/fill curves for the HB AMAX Solution Mine Extension Project. The working-specific curves would be used to understand the actual fill volume versus elevation and verify that brine levels are being maintained at prescribed elevations in the underground flood zone.
- Wells within and immediately adjacent to the flood zone have been evaluated with respect to integrity, proximity to the flood zone, and the need for further abandonment procedures. Accordingly, wells 30015045970000, 30015045990000, and 30015046000000 were plugged by April 2015.
- Adaptive management strategies involving modification of Rustler pumping rates would be employed if drawdown impacts are observed at the caves from the continuation of the existing monitoring network.
- Intrepid would work with the BLM to determine proper well plugging procedures for wells that are installed in areas of high karst potential. Proper plugging would minimize future impacts to karst features.
- Prior to trenching the BLM will identify which portions of the pipeline alignment will require an onsite karst monitor during construction. If a void were encountered during excavation of the trenches or during drilling operations, construction will be suspended and the BLM will be notified. BLM would then work with Intrepid to determine proper mitigation.
- Subsidence at the HB Solar Solution Mine would continue to be assessed on a regular basis. If data collected for the HB Solar Solution Mine continues to demonstrate a lack of discernable trends or is within the modeled allowable subsidence rate described in the Evaluation of Ground Subsidence over the Intrepid HB Mines, Carlsbad, New Mexico, RESPEC, April 2011 prepared for the FEIS, additional monitoring would not be conducted for the Amax Mine area. If the observed subsidence, as documented by the existing subsidence monitoring network shows a definitive trend and approaches the limits established in the EIS, a subsidence network for the AMAX Mine would be evaluated in conjunction with the BLM.
- A qualified paleontological inspector would be used to spot monitor for fossils during grubbing and after trenching construction of the pipeline in the vicinity of the siltstone, sandstone, and gypsum bluff where it intersects the pipeline ROW leading to well pad IP-304 (NE ¼, Section 14, T19S, R30E). Any paleontological resources (prehistoric site, object, or remains discovered during project construction would be reported immediately to the BLM. Such a discovery would suspend operations until approval to proceed is received from the authorized officer. The authorized officer would also determine the appropriate actions needed to prevent and mitigate any loss of significant paleontological resources within the defined level 4 / ROW intersected area.

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### **3.1.4. Impacts from Alternative**

#### **Direct and Indirect Impacts**

Under the Alternative, the impacts to geology resources including subsidence, karst, mineral resources, and paleontology would be the same as those described in the Proposed Action.

## **3.2. Water**

### **3.2.1. Affected Environment**

Water resources have been divided into surface water and groundwater sections to describe the affected environment. In reality, surface water and groundwater systems are often connected and impacts to one may impact the other.

#### **Surface Water**

Surface water resources have been characterized for the proposed project area and include wetlands, lakes, playas, and streams. The affected surface water environment covers the following:

- Climate
- Watersheds
- Floodplains
- Wetlands
- Surface water quality
- Surface water usage

#### ***Climate***

Climate parameters such as temperature, precipitation, and evaporation are key factors in determining and understanding the hydrology of a region. Climate parameters determine the amount and frequency of water available for surface runoff and for groundwater recharge. Using Köppen climate designations, the project location is in a BSk climate (Kottek et al. 2006). BSk climates are found in dry, mid-latitude regions with average temperatures less than 64 degrees Fahrenheit (°F) (18 degrees Celsius [°C]) and potential evaporation rates that exceed precipitation (NOAA 2011). The nearest climate station with historical and current climate data is the Carlsbad, New Mexico station (# 291469) located approximately 25 miles southeast of the project site and 200 ft lower in elevation.

Carlsbad temperature and precipitation records from February 1, 1900 to March 31, 2013 (WRCC 2014) are displayed in **Figure EA-9 – Climate Data**. The average annual maximum and minimum temperatures are 78.6°F and 47.2°F. June and July are the warmest months; December and January are the coldest months. Average annual precipitation is 12.84 inches; July, August, and September are the wettest months. Brief, but intense thunderstorms deliver most of the summer precipitation. The Western Regional Climate Center (WRCC) estimates an average potential evaporation rate of 73 inches/year for southeastern New Mexico; the closest weather station with evaporation data is at Brantley Dam where the measured average potential evaporation is 109 inches/year. Potential evaporation rates far exceed annual precipitation, resulting in a moisture deficit. With little rainfall and high evaporation rates, few streams have streamflow year round; most streams are ephemeral.

#### ***Watersheds***

Watersheds provide information on surface water drainage. The Watershed Boundary Dataset (USDA-NRCS et al. 2014) divides the United States into hierarchical hydrologic units, generally synonymous with the classic definition of a watershed, except that hydrologic units may have multiple outlets and can accept water from outside the unit boundary. The largest hydrologic units are called regions; the United States is divided into 15 regions. Each region is split into subregions made up of basins, divided into subbasins, then watersheds, and finally subwatersheds. The subwatershed is the

smallest division in the Watershed Boundary Dataset. A hydrologic unit is assigned a Hydrologic Unit Code (HUC) with each level of the hierarchy represented by two digits; subwatersheds have a 12-digit code (HUC-12).

The National Hydrography Dataset (NHD) identifies surface water bodies including streams, rivers, canals, lakes, and ponds (USGS 2014). Stream channels are named using the HUC-12 subwatershed code from the Watershed Boundary Dataset followed by additional numbers to differentiate between stream reaches. Together, these stream reaches makes up the flow network. A map displaying subwatersheds and surface water features in and near the project boundary can be found in **Map EA-12 - Watershed Map**.

The five subwatersheds listed in **Table 3.2-1 - Subwatersheds that are In / Intersect the Project Boundary (USGS 2014)** are fully or partially contained in the project boundary. Of these five subwatersheds, three are closed basins, one drains into a closed basin, and one to a connected watershed that eventually flows into the Pecos River. These subwatersheds and associated surface water features are discussed below.

**Table 3.2-1 Subwatersheds that are In / Intersect the Project Boundary (USGS 2014)**

Region	Subregion	Basin	Sub Basin	Watershed	Subwatershed	HUC12 ID	Contributing To/Closed
Rio Grande	Upper Pecos	Upper Pecos	Upper Pecos – Black	Clayton Basin	Clayton Basin	130600110204	Closed
					Nimenim Ridge	130600110202	Clayton Basin
					Little Lake	130600110203	Closed
				Burton Flat	Burton Flat	130600110104	Scanlon Draw-Pamilla Draw
					130600110103	130600110103	Closed
					Cedar Lake Draw	130600110102	130600110103

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### Clayton Basin

Clayton Basin is intersected by the southern edge of the project boundary. Clayton Basin is a closed basin bound by topographic highs. Streams in the eastern portion of the basin are classified as intermittent in the NHD meaning they do not continuously carry flow but do contain water more often than ephemeral streams; an ephemeral stream only has flow immediately after precipitation events (Dingman 2002). Clayton Basin also has several intermittent lakes and treatment reservoirs.

### Burton Flat

Burton Flat is intersected by the western project boundary. Burton Flat is the only subwatershed in the project boundary that is not classified as closed or connected to a closed subwatershed. Theoretically, water in Burton Flat could flow into Scanlon Draw-Pamilla Draw, then into Lone Tree Draw, and finally into the Pecos River. However, this subwatershed is almost flat and there are no mapped streams, suggesting that surface water flow is rare. Burton Flat is a known karst terrain and most of the surface water flow likely enters the shallow karst aquifers through cave entrances, swallets and sinkholes (Goodbar 2013).

### 130600110103

Subwatershed 130600110103 is intersected by the western project boundary. This is a closed subwatershed with one surface water feature along the western edge outside the project boundary. Like the streams in Clayton Basin this stream is classified as intermittent.

### Nimenim Ridge

Nimenim Ridge is intersected by the northern project boundary. While not a closed basin, Nimenim Ridge is connected to the closed Clayton Basin. Nimenim Ridge is a long, thin subwatershed oriented roughly northeast to southwest. There are several intermittent streams in this subwatershed; the majority of streams within the project boundary are in Nimenim Ridge. There are also several small (<0.01 square



kilometers) intermittent lakes and two perennial lakes within the project boundary. The largest perennial lake is associated with an old tailings basin. The intermittent lakes are likely playas that collect runoff, which then evaporates and leaves behind dissolved salts. Over time, these salts deposits accumulate and decrease the soil permeability, supporting continued water pooling during future precipitation events.

#### **Little Lake**

The eastern edge of the project boundary intersects the Little Lake subwatershed. This subwatershed is separated from Clayton Basin by a minor ridge at the southwest edge. This is a closed basin with two intermittent streams that drain into a small intermittent lake.

#### **Cedar Lake Draw**

The northern edge of the project boundary intersects the Cedar Lake Draw subwatershed. This is an open basin that contributes to the closed basin, 130600110103. There are several intermittent streams at the northeastern edge of the watershed.

### ***Floodplains***

The Federal Emergency Management Agency (FEMA) produces and maintains the floodplain maps used by the National Flood Insurance Program (FEMA 2010). Zone A Special Flood Hazard Areas are within the 100-year floodplain and are defined as areas with  $\geq 1\%$  probability of flooding in a given year (FEMA 2014). FEMA describes Zone A as “No base flood elevations determined.” Zone A areas within the Proposed Project boundary are shown in **Map EA-13 - FEMA Flood Hazard Area Map**.

There are six 100-year floodplains within the project boundary. Three floodplains are located at the western edge of the project boundary away from the proposed pipelines and wells. The other three floodplains are along the southern edge of the project boundary. All infrastructure for the Proposed Action is more than half a mile from Zone A floodplains.

### ***Wetlands***

Wetland maps (USFWS 2010) of the United States are maintained by the National Wetlands Inventory (NWI) established by the U.S. Fish & Wildlife Service (USFWS). The NWI delineates the areal extent of wetlands and surface waters using a classification system proposed by Cowardin et al. (1979). This hierarchical wetland classification system classifies wetlands based on hydrologic, geomorphologic, chemical, and biological factors. The wetlands dataset from the NWI was used to generate a wetlands map for the project area (**Map EA-14 - Surface Water Bodies**).

Under the Cowardin et al. (1979) classification system lakes and streams from the NHD are classified as lakes or freshwater ponds and riverine wetlands, respectively. There was only one other wetland type, a freshwater emergent wetland, within the project boundary. The freshwater emergent wetland category includes herbaceous marshes, fens, swales, and wet meadows.

**Table 3.2-2 - Total Area for Each NWI Wetland Type Within the Project Boundary** summarizes the area for each wetland type within the project boundary. In total, there are 178.5 acres of wetlands within the project boundary; wetlands cover 1.% of the project area. Lakes represent the majority of wetlands within the project boundary.

**Table 3.2-2 Total Area for Each NWI Wetland Type Within the Project Boundary**

<b>Wetland Type</b>	<b>Total Area (Acres)</b>	<b>Percentage of Project Area (%)</b>
Freshwater Emergent Wetland	0.7	0.003
Riverine	18.5	0.1
Freshwater Pond	33.2	0.2
Lake	126.1	0.7

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Checked By: BAL3

No wetlands, as defined by the NWI are positioned closer than 2.2 miles from any new proposed HB AMAX Solution Mine Extension Project infrastructure.

### ***Surface Water Quality***

Surface water quality standards and waterway beneficial use designations for the State of New Mexico are developed by the New Mexico Water Quality Control Commission (NMWQCC). There are no classified waters within the project boundary and all surface water features are either unclassified perennial waters of the State or unclassified intermittent waters of the State. Both unclassified perennial and intermittent waters have designated uses listed in 20.6.4.98 NMAC and 20.6.4.99 NMAC as: livestock watering, wildlife habitat, and primary contact. Perennial waters also have a warmwater aquatic life designation; intermittent waters have a marginal warmwater aquatic life designation (NMAC 2000). Water quality standards for these designated uses can be found in 20.6.4.900 NMAC.

In addition to the standards for unclassified waters, the State of New Mexico has a basinwide provision (20.6.4.52 NMAC) for preventing increased total dissolved solids (TDS) in the Pecos River Basin pursuant to the New Mexico Water Quality Act. One subwatershed, Burton Flat, intersected by the project boundary is hydrologically connected to the Pecos River. However, no streams have been mapped in Burton Flat and the potential for surface flow to the Pecos River is low. All of the subwatersheds have the potential to be connected to the Pecos River through the groundwater system and fall within the Pecos River Basin boundary. Additional water quality standards for the main stem of the Pecos River are total dissolved solids threshold goals of 500 milligrams per liter (mg/L) at Santa Rosa, 2,700 mg/L near Artesia, and 3,600 mg/L near Malaga.

Surface water quality in New Mexico is regulated by the NMED, Surface Water Quality Bureau (SWQB). In accordance with the requirements of the Clean Water Act (CWA) the SWQB prepares a CWA §303(d)/305(b) Integrated Report ("Integrated Report") on water quality parameters and impairments for the U.S. Environmental Protection Agency (USEPA). The most recent Integrated Report from the SWQB was released November 18, 2014 (NMWQCC 2014).

No water bodies within the project area are listed in the 2014 Integrated Report as impaired waters. The closest impaired waters to the project boundary is the Pecos River. Several sections of the Pecos River are listed in the 2014 Integrated Report, including the Avalon Reservoir, which is listed for mercury in fish tissue and the Brantley Reservoir, which is listed for dichlorodiphenyltrichloroethane (DDT) in fish tissue. The Pecos River is approximately 14 miles east of the project boundary and may be hydrologically connected through Burton Flat or groundwater discharge. The closest river section is between Brantley Reservoir and Avalon Reservoir. There is no direct surface water drainage from the project area to the Pecos River.

### ***Surface Water Use***

The New Mexico Office of the State Engineer (NMOSE) administers water use in the State of New Mexico. The online NMOSE water rights database is currently being updated for Eddy County. A search for water rights in and within one mile of the project boundary was completed using NMOSE – Roswell, New Mexico records in 2014. No surface water rights were found within the project boundary.

Surface water provisions from the nearby Pecos River are administered by a commission, as outlined in the Pecos River Compact between the State of New Mexico and the State of Texas. The compact was approved by Congress in 1949 (NMOSE and ISC 2015).

## Groundwater

Water for the processing plant and for injection would come from three existing well fields – a well field in the Ogallala aquifer (Caprock Well Field), a well field in the Rustler Formation (North Rustler Well Field) and a well field being developed (South Rustler Well Field). In addition, injectate make-up water would come from Intrepid's North Plant scrubber water (Caprock water with KCl) or from Intrepid's existing brine recycling process at the West plant facility.

The North Rustler Well Field is located approximately 10 miles south of the AMAX Mine and the Caprock Well Field is 30 miles northeast of the HB AMAX Solution Mine Extension Project, as shown in **Map EA-15 – Location of the Rustler Section 2 Well Field** and **Map EA-16 – Location of the Caprock Well Field Relative to Project Area**. The third well field (South Rustler Well Field) is located downgradient from the Intrepid West tailing facility in lower Nash Draw.

In addition to these aquifers of interest, this section discusses the aquifers and aquitards (hydrostratigraphic units) that have regional significance in the project area.

### Hydrostratigraphy

The following hydrostratigraphic units, from deepest (oldest) to shallowest (youngest), occur in the northern Delaware Basin where the HB AMAX Solution Mine Extension Project is located:

- Bell Canyon aquifer
- Capitan Formation aquifer
- Castile Formation aquitard
- Salado Formation aquitard
- Los Medanos Member aquifer/aquitard (of the Rustler Formation)
- Culebra Dolomite Member aquifer (of the Rustler Formation)
- Tamarisk Member aquitard (of the Rustler Formation)
- Magenta Dolomite Member aquifer (of the Rustler Formation)
- Forty-Niner Member aquitard (of the Rustler Formation)

The overlying Santa Rosa Formation, Dewey Lake Red Bed Formation, and unconsolidated deposits may locally yield water, but do not act as regional aquifers. . The Ogallala Formation, while not present at the project site, is a water source for the project and is included in the affected groundwater environment.

### **Bell Canyon Aquifer**

The Bell Canyon Aquifer is in the upper sandstone units of the Bell Canyon Formation. The Bell Canyon Formation is a deep water turbidite sandstone that was deposited on the basin side of the Capitan Reef, grading into carbonates toward the edge of the Capitan Reef and finer siltstones and shales moving deeper into the basin. The aquifer is confined both by the underlying Lamar Shale Member of the Bell Canyon Formation and the overlying Castile evaporites (Mercer 1983).

Porous sandstone units are 45 to 60 ft thick and occur in the upper 600 ft of the Bell Canyon Formation. Interbedded siltstones and the heterogeneity of cementation create locally confined layers within the aquifer; large hydraulic head differences have been observed in adjacent sandstone units. Well yields are typically less than 5 gpm (Mercer 1983). Groundwater flow is generally toward the northeast (Intrepid/Shaw 2008a). Recharge is from the west, possibly in the Guadalupe and Delaware Mountains. Regional flow through the aquifer is thought to be slow with intervening, low permeability siltstones impeding water movement. Most water produced from the Bell Canyon aquifer is a brine; the TDS, as measured at the Waste Isolation Pilot Project (WIPP) site, ranged from 180,000-270,000 mg/L. TDS generally increases in the Bell Canyon Aquifer as water moves across the Delaware Basin (Mercer 1983).

Moving laterally toward the basin margin, the Bell Canyon Formation is in contact with the Capitan Limestone (Figure EA-8). Even though the Capitan Limestone abuts the Bell Canyon Aquifer, the different hydrogeologic characteristics of these two systems likely limits interaction; the hydraulic conductivity in the Bell Canyon aquifer is typically several orders of magnitude smaller than in the Capitan Aquifer. This lack of interaction is supported by the distinct water chemistry observed in these two aquifers (Mercer 1983).

### **Capitan Aquifer**

The Capitan Aquifer includes the Capitan Limestone, the Goat Seep Formation, and the carbonate portions of the Artesia Group, including the Grayburg, Queen, Seven Rivers, Yates, and Tansill Formations. The Capitan Aquifer is a horseshoe shaped formation that outlines the margins of the Delaware Basin and is only absent on the southern edge of the basin. At the northern edge of the Delaware Basin, near the project site, the Capitan Aquifer is 10 to 14 miles wide (Mercer 1983). The thickness of this aquifer is variable with thicker sections behind the foreereef and thinner sections were submarine canyons and surge channels eroded the reef surface. Near the project site the reef is generally 1,500-2,000 ft thick in the middle of the reef complex and thins toward the edges (Standen et al. 2009).

The hydraulic conductivity of the Capitan Aquifer varies from 1-25 ft per day (ft/day), with an average near Carlsbad of 5 ft/day (Mercer 1983). Secondary porosity from karst formation can greatly increase local porosity and create preferential flowpaths for groundwater. Well yields near Carlsbad are often greater than 1,000 gpm (Standen et al. 2009). West of the Pecos River the Capitan Aquifer outcrops and is recharged in the Guadalupe Mountains. Lake Avalon located northeast of Carlsbad has also been identified as a local recharge area (Richey and Wells 1985). East of the Pecos River the Capitan Aquifer becomes confined by the overlying Salado and Castile Formations, when present (Standen et al. 2009). The higher hydraulic head in the underlying Delaware Mountain Group prevents significant downward movement of groundwater (Richey and Wells 1985). Lateral groundwater movement follows the reef structure starting at the recharge zone in the Guadalupe Mountains and moving east with a major discharge zone near Wink, TX (Standen et al. 2009). Locally, water from the Capitan Aquifer discharges to the Pecos River at Carlsbad Springs (Mercer 1983).

Water quality in the Capitan aquifer is variable. Southwest of Carlsbad salinity is generally low and water is used for domestic consumption. East of the Pecos River the water can be saline and is used for agricultural and industrial purposes (Richey and Wells 1985).

### **Castile Formation Aquitard**

The Castile Aquitard overlies the Bell Canyon Formation in the deep water depositional environment of the Delaware Basin. Toward the Capitan Reef where water levels were shallower the Castile Aquitard thins substantially and is absent in the backreef of the Northwestern Shelf. This aquitard is a thick anhydrite series with thinly interbedded halite layers. Within the deep basin the Castile Formation is generally 1,500 to 1,850 ft thick. The hydraulic conductivity of the Castile Formation is so small it is considered unmeasurable. Occasional brine pockets associated with fractures have been found in the Castile Formation but a regional groundwater flow system is assumed to be absent (Mercer 1983).

### **Salado Formation Aquitard**

The Salado Formation is a thick evaporite sequence with low hydraulic conductivity. Unit thickness at WIPP ranged from 1,700 – 2,000 ft. Occasional brine pockets have been found in the Salado Formation but there is no evidence of groundwater movement within the formation. Dissolution has been observed at the top of the Salado and a brine aquifer may be present between the Salado and the overlying Los Medaños Member of the Rustler Formation. This brine aquifer is considered to be part of the Los Medaños Aquifer (Mercer 1983).

### **Rustler Formation Aquifers and Aquitards**

Three aquifers (Los Medaños Member, Culebra Member, Magenta Member) and three aquitards (Los Medaños Member, Tamarisk Member, and Forty-Niner Member) have been identified in the Rustler Formation.

The Los Medaños Member of the Rustler Formation contains both an aquifer and an aquitard. The majority of the formation is a siltstone, anhydrite, and fine-grained sandstone that generally acts as an aquitard. The base of this member has a discontinuous breccia zone that formed at the contact of the overlying Rustler Formation and underlying Salado Formation. The breccia layer consists of gypsum and sandstone fragments in a clay residuum. Dissolution of the top of the Salado Formation has created a local brine aquifer in the breccia layer, when present. The thickness of this brine aquifer ranges from 10 to 60 ft and averages 24 ft. The extent of the aquifer is unknown; it has been identified as far south as U.S. Route 285 and as far north as U.S. Route 180. It trends northeast – southwest from U.S. Route 285 to Nash Draw and north-south from Nash Draw to U.S. Route 180. Within this zone the width varies between 2 and 8 miles. Recharge may occur in Bear Grass Draw while discharge from the Los Medaños aquifer has been identified at Malaga Bend in the Pecos River. Groundwater flow is generally to the south/southwest (Mercer 1983).

The Culebra Dolomite Aquifer is the deepest, regionally extensive aquifer in the Rustler Formation sequence. This silty, thinly bedded to massive dolomite carries groundwater in bedding planes and fractures. Aquifer thickness observed in Intrepid's wells ranges from 18-23 ft. The Culebra Dolomite is considered the most persistent and productive hydrologic unit in the area. Where dissolution has not occurred, this aquifer is confined above by the thick anhydrite of the Tamarisk Aquitard and below by the siltstone and anhydrite layers of the Los Medaños Member. Near Nash Draw and Salt Lake dissolution of the Salado below, and of the Tamarisk above, has caused collapse in the Culebra and Magenta Members and hydraulic communication between these two, otherwise confined, units. The Culebra is likely recharged in Bear Grass Draw and discharges to Salt Lake; groundwater flow is generally to the south. Hydraulic conductivity can be quite variable in the Culebra Aquifer depending on the extent of secondary porosity introduced by fractures and collapse features. Transmissivity measured at the WIPP site was generally 1 ft<sup>2</sup>/day. Transmissivity measured in wells near Nash Draw was several orders of magnitude larger because of additional fracturing and probable conduit flow. Water quality is generally marginal with observed TDS values ranging from 3,200 to 420,000 mg/L. When TDS levels allow, groundwater from the Culebra aquifer is used for stock watering and is rarely a domestic water source (Mercer 1983).

The Magenta Dolomite Aquifer consists of siltstone, silty dolomite, and occasional anhydrite beds. Aquifer thickness observed in Intrepid's wells ranges from 11-29 ft. Groundwater transport occurs along bedding planes and in fractures. Where dissolution has not highly altered the structure of the Rustler Formation and where the Magenta is not outcropping at the land surface, the overlying Forty-Niner Member can act as an aquitard and create confining conditions. Within Nash Draw the aquifer is generally unconfined due to the hydraulic connection with the underlying Culebra Dolomite. However, even within Nash Draw the Magenta aquifer may be locally confined. Large head differences between the Culebra Dolomite and the Magenta Dolomite were also observed at the WIPP site and suggest confined conditions. Water quality is variable with TDS values ranging from 5,460 to 270,000 mg /L (Mercer 1983).

Where it has not been eroded, the Forty-Niner aquitard confines the underlying Magenta Dolomite. This aquitard is an anhydrite with a single thin bed of clayey silt (Mercer 1983). Where the Forty-Niner outcrops at or near the surface in Burton Flat there are numerous cave entrances. These entrances provide point sources for rapid groundwater recharge. These caves provide habitat for aquatic troglobitic species (Goodbar 2015).

### **Formations above the Rustler**

None of the formations above the Rustler are regionally continuous hydrostratigraphic units but they may locally act as an aquifer or an aquitard. The Dewey Lake Red Beds (Quartermaster Formation) overlie the Rustler Formation. The Dewey Lake Red Beds at WIPP are 345-541 ft thick (Mercer 1983); within the project area this unit is discontinuous and of variable thickness due to erosion. The Dewey Lake Red Beds are generally a low permeability unit that, when present, contain little to no groundwater. Trace

amounts of groundwater may be found in lenticular sand layers (Mercer 1983). The Santa Rosa Formation is a sandstone that overlies the Dewey Lake Red Beds. The Santa Rosa is 0 to 176 ft thick at the WIPP site (Mercer 1983). While the Santa Rosa Formation is a principal aquifer in Lea County, this unit has been eroded away over much of project site. WIPP wells completed in the Santa Rosa produced little to no water (Mercer 1983). The Gatuña Formation is a discontinuous, poorly sorted, silt, clay and sand unit with erratic distribution. At the WIPP site it was absent in some borings and up to 100 ft thick in others. No water was found in the Gatuña Formation at the WIPP site; isolated, perched occurrences of water are possible in the sand-rich lenses. A lack of regional continuity prohibits lateral groundwater flow through the Gatuña Formation. Quaternary, unconsolidated alluvial and eolian deposits range from 0 to tens of feet thick and may locally contain water. When present, groundwater within the quaternary material is generally perched or semi-perched.

### Ogallala Aquifer

The Ogallala Aquifer is part of the large, regionally extensive High Plains Aquifer covering parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming. This aquifer is a major source of water for irrigation and domestic consumption (USGS 2014). In southeastern New Mexico the Ogallala Formation has interbedded layers of sand and gravel capped with a caliche layer. Cementation is greatest near the surface and becomes poorly cemented with depth. The saturated thickness of the Ogallala Aquifer ranges from a few feet to 250 ft. The thickness of the upper caliche layer ranges from a few to 60 ft. Water quality is generally good with TDS values ranging from 300 to 729 mg/L in Lea County (NMOSE 1999).

### Groundwater Use

Like surface water rights, groundwater rights are managed by the NMOSE. A search for groundwater water rights in and within one mile of the project boundary was conducted using data from the NMOSE office in Roswell, New Mexico. Twenty-four (24) groundwater rights were found within the project boundary.

**Table 3.2-3 - Water Rights Within One Mile of the Project Boundary** summarizes the permit amount, use type, owner, and status for the groundwater rights in and within one mile of the project boundary.

**Map EA-17 - Water Rights Within 1 Mile of HB AMAX Project Boundary** shows the locations of the groundwater rights. All of these rights are listed within the Capitan Basin, as designated by the "CP" in the NMOSE file number.

**Table 3.2-3 Water Rights Within One Mile of the Project Boundary**

Owner/Permittee	NMOSE File #	Location (T-R-S)	Use	Allotment (ac-ft)	Status	Source
Mosaic Potash	CP-378	19S-30E-09	IND	1,371	Declared	GW
Mosaic Potash	CP-379	19S-30E-10	IND	484	Declared	GW
Snyder Ranch	CP-819	18S-30E-32	STK	3	Declared	GW
Snyder Ranch	CP-820	19S-29E-13	STK	3	Declared	GW
Snyder Ranch	CP-821	19S-29E-25	STK	3	Declared	GW
Snyder Ranch	CP-822	19S-30E-15	STK	3	Declared	GW
Snyder Ranch	CP-823	19S-30E-17	STK	3	Declared	GW
Snyder Ranch	CP-824	19S-30E-20	STK	3	Declared	GW
Snyder Ranch	CP-825	19S-30E-28	STK	3	Declared	GW
Snyder Ranch	CP-827	19S-30E-35	STK	3	Declared	GW
Snyder Ranch	CP-828	19S-30E-35	STK	3	Declared	GW
Snyder Ranch	CP-834	20S-30E-06	STK	3	Declared	GW
H.R. Carpenter	CP-522	19S-30E-30	STK	3	Unknown	GW
Southwest Royalties	CP-357	19S-30E-24	PRO	48	Unknown	GW

Owner/Permittee	NMOSE File #	Location (T-R-S)	Use	Allotment (ac-ft)	Status	Source
Southwest Royalties	CP-357-S	19S-30E-24	PRO	48	Unknown	GW
Southwest Royalties	CP-357-x-2	19S-30E-24	PRO	48	Unknown	GW
P.R. Patton	CP-767	19S-30E-03 19S-30E-04	PRO	300	Withdrawn	GW
P.R. Patton	CP-773	18S-30E-28	PRO	300	Withdrawn	GW
Devon Energy	CP-703	19S-29E-36	PRO	3	Permitted	GW
CHI Operating	CP-1226*	19S-29E-36	PRO	3	Expired	GW
CHI Operating	CP-1227*	19S-29E-36	PRO	3	Expired	GW
CHI Operating	CP-1228*	19S-29E-36	PRO	3	Expired	GW
Fred Pool	CP-742	19S-30E-31	PRO	3	Expired	GW
A	CP-647	19S-30E-15			Unknown	Unknown

**Notes:**

\*: using CP-703 well for fracking and completion of CHI Operating Inc. project well.

ac-ft: acre-ft

GW: Groundwater

IND: Industrial

OSE: Office of the State Engineer

PRO: Prospecting of development of natural resources

STK: Livestock

T-R-S: Township – Range – Section

Prepared by: MJH5

Checked by: BAL3

Water rights near Intrepid's Rustler and Caprock Formation well fields have been evaluated and discussed in the EIS. Intrepid has established water rights from the NMOSE to use up to 4,353 ac-ft per year (2,697 gpm) of Rustler water from the Rustler Formation groundwater supply wells installed for use in the HB Solar Solution Mine. Intrepid also maintains water rights that allow for the use of up to 7,700 ac-ft per year (4,771 gpm) from the West, East, North, and HB Caprock well fields. Only existing water rights would be used for the Proposed Action; no new water rights would be obtained.

### **3.2.2. Impacts from the No Action Alternative**

#### **Direct and Indirect Impacts**

Under the No Action Alternative there would be no impacts to surface water resources in the project area beyond those small areas of surface disturbance resulting from current potash mining and oil and gas activities.

Groundwater pumping at Intrepid's Rustler and Caprock Formation well fields would continue to occur for the HB Solar Solution Mine. The total duration of pumping would be shorter. Minor amounts of groundwater extraction would likely occur for oil and gas activities.

Under the No Action Alternative the abandoned oil wells near the AMAX Mine would remain plugged. There may be a potential hazard to aquifer systems as the cement ages and deteriorates; cement failure could potentially open up preferential pathways between otherwise confined aquifer units, allowing for migration of brine and production formation water into freshwater zones.

### 3.2.3. Impacts from the Proposed Action

#### Direct and Indirect Impacts

##### Surface Water

Under the Proposed Action none of the new roads, pipelines, or utility corridors is within 650 ft of 100-year floodplains (Map EA-13). The majority of the 100-year floodplains are located west of the proposed infrastructure. The pipeline from IP-302 and IP-304 crosses two unnamed, intermittent streams.

Temporary water quality impacts associated with construction could occur and would be managed with best management practices to prevent storm water pollution.

Buried pipelines, as outlined for the Proposed Action, have less impact to surface water drainages, relative to aboveground pipelines. Roads adjacent to the buried pipelines have the potential to block, divert, or concentrate storm water runoff if the natural land grade is altered. Surface runoff can erode roads and potentially uncover pipelines if erosion is severe enough. The access road along the pipeline has an increased potential for erosion due to removal of vegetation. To avoid and minimize the potential for these negative impacts, mitigation has been developed and is presented below in the mitigation section. The power line corridors should cause little to no impedance to surface water flow as long as existing land grades are maintained.

Under the Proposed Action the total initial disturbance footprint during the construction phase totals 84.3 acres, including disturbance from pipeline burial, well pad construction, and power line corridors. The long-term disturbance totals 46.8 acres and represents disturbance during the operational phase of the project before final reclamation. The initial and long-term disturbance is summarized by sub-watershed in **Table 3.2-4 - Initial Disturbance in each Subwatershed for the Proposed Action** and **Table 3.2-5 – Long-term Disturbance in each Subwatershed for the Proposed Action**. Half of the disturbance is in subwatershed Clayton Basin with lesser amounts in Nimenim Ridge and 130600110103; no disturbance would occur in Burton Flat or Little Lake. Disturbance in any given subwatershed is less than 0.1% of the subwatershed area. All project disturbance is in closed basins or subwatersheds connected to closed basins.

**Table 3.2-4 Initial Disturbance in each Subwatershed for the Proposed Action**

Subwatershed (HUC-12)	Total Disturbed (acres)	% HUC-12
Burton Flat	0.0	0.00
Little Lake	0.0	0.00
130600110103	21.6	0.08
Clayton Basin	43.5	0.08
Nimenim Ridge	19.2	0.06
Cedar Lake Draw	0.0	0.00
<i>Total</i>	<i>84.3</i>	<i>0.22</i>

Notes

1. Percentage of the HUC-12 was calculated using the USGS HUC Area, defined as the "area of subwatershed including non-contributing areas."
2. The disturbed area was rounded up to the nearest tenth of an acre.

Prepared By: MJH5  
Checked By: BAL3



**Table 3.2-5 Long-term Disturbance in each Subwatershed for the Proposed Action**

<b>Subwatershed (HUC-12)</b>	<b>Total Disturbed (acres)</b>	<b>% HUC-12</b>
Burton Flat	0.0	0.00
Little Lake	0.0	0.00
130600110103	13.6	0.05
Clayton Basin	21.9	0.04
Nimenim Ridge	11.3	0.03
Cedar Lake Draw	0.0	0.00
<i>Total</i>	<i>46.8</i>	<i>0.12</i>

**Notes**

1. Percentage of the HUC-12 was calculated using the USGS HUC Area, defined as the "area of subwatershed including non-contributing areas".
2. The disturbed area was rounded up to the nearest tenth of an acre.

Prepared By: MJH5  
Checked By: BAL3

The disturbance summary evaluates total disturbance, regardless of prior disturbance. Much of the pipeline corridor is in or adjacent to previously disturbed areas (see Map EA-4). Existing rail grades or roadways may already have adaptations for surface water conveyance, including ditches and culverts, which would reduce additional alterations to surface water drainages from the Proposed Action.

There is a potential to impact water quality if a pipeline leak develops. A leak or catastrophic break in a pipeline would result in the release of brines ranging from relatively fresh water (dilution lines) to saturated brine. Monitoring and mechanical controls for such an event are discussed in the mitigation section. Road crossing upgrades to stabilize the erosional features near IP-302 should improve downstream water quality by reducing the sediment loads during flow events.

## **Groundwater**

Impacts to groundwater are primarily associated with pumping of the Rustler and Ogallala Aquifers and potential water quality degradation from brine fluid leaks. Drawdown from aquifer pumping could impact cave ecosystems as well as affect other aquifer users. Minor impacts during well construction are possible from drilling through aquifer units; drilling fluids may enter the aquifer. The mitigation measures that would be used to reduce these construction impacts are discussed in the mitigation section.

Groundwater impacts were analyzed separately for the Caprock well field and the Rustler well field for the EIS. Two numerical groundwater models, a Preferred Model and an Enhanced Model, were developed for the Rustler well field. The Enhanced Model used slightly higher hydraulic conductivity values, relative to the Preferred Model, and produced results that were more similar to the observed drawdown. A single, analytical model was used to evaluate the Caprock well field. All of the pumping scenarios for both the Rustler Aquifer models and the Caprock Aquifer model were run using a steady state simulation. A summary of the modeling methodology, applicability to the Proposed Action, and availability of new hydrogeologic data are presented in the TM-EA-002: Analysis and Applicability of the Hydrological Assessment and Groundwater Modeling Report for the HB In-Situ Solution Mine Project EIS (AECOM 2011) to the Proposed HB AMAX Solution Mine Extension Project to the HB Solar Solution Mine, (May 2015), included in Appendix C.

Predicted drawdown obtained from a steady state analysis, such as the results from the Caprock and Rustler Aquifer models, are not estimates of the drawdown at any particular phase or point in time. These results are estimates of the drawdown that would occur if the wells were pumped at the assigned rates in perpetuity. The point at which such equilibrium drawdown is reached could occur during the project or at

some point after the project. Therefore, these drawdown predictions are not projected drawdowns of any given project year; rather, they are estimates of the maximum drawdown expected if the well field were operated at the given pumping rates in perpetuity. Because the Proposed Action uses pumping rates as modeled for the HB Solar Solution Mine EIS, the modeled drawdown presented in the EIS also represents the maximum drawdown expected under the Proposed Action.

Several pumping alternatives were evaluated for the EIS. The actual pumping that is occurring and would be used for the Proposed Action is as described for Alternative B from the EIS (BLM 2012). Under Alternative B, only the existing North Rustler well field (located to the north and east of the solar evaporation ponds) and Caprock wells were used; no water was obtained from the Rustler wells located at the former PCA facility in Section 4, T20s, R30E. A maximum sustainable pumping rate (the rate at which wells could be pumped and not go dry) was estimated for the Rustler Aquifer wells with additional water demand met by the Caprock Aquifer wells. **Map EA-18 - Modeled Drawdown as Compared to Actual Observed Drawdown** shows the modeled, maximum drawdown for the Preferred and Enhanced Models as well as the observed drawdown from April 2014. Pumping began in August 2012. The observed drawdown is substantially less than the modeled drawdown. Also shown in Map EA-18 is the location of Bear Grass Draw, relative to the predicted drawdown. Bear Grass Draw, identified as a potential recharge zone for the groundwater system, is outside the predicted cone of depression.

The actual sustainable pumping rates from 2012 through 2014 were significantly higher than the model predicted; the Rustler Aquifer wells are being pumped at a higher pumping rate than modeled and the observed drawdown is still less than the model predicted. The modeled drawdown intentionally reflected a worst-case, conservative estimate with which to conduct the associated resource impact analysis for the EIS, which likely reflects why actual drawdown is different than modeled drawdown. It is also unknown where the groundwater system is in relation to steady state; drawdown may continue to expand until steady state is reached. Given the current observed drawdown after approximately three years of pumping and considering the degree of conservancy built into the model methodology, it is unlikely that actual drawdown would reach or exceed the modeled drawdown.

To summarize, no additional groundwater impacts, besides those already addressed in the EIS, are expected. The timing of impacts remains unknown because the predicted drawdown reflects steady state. If steady state is not reached before the end of the project, drawdown could continue to increase every year throughout operations. The additional 14 years of pumping for the Proposed Action could result in an increase in observed impacts, up to the maximum predicted steady state impacts. Therefore, if steady state is not reached before year 28, then the extended duration of pumping for the Proposed Action could have an impact on actual water level declines, relative to the No Action Alternative. However, the maximum expected modeled drawdown would likely still be the same as shown in the EIS. Total expected impacts were fully addressed in the EIS and it is not likely the observed drawdown will exceed the modeled drawdown predicted for the EIS.

Water quality degradation of groundwater resources is possible if a pipeline leak developed and process water recharged an underlying aquifer. Similar degradation is possible if a leak developed in the well casing and process water migrated into a surrounding aquifer. These potential water quality impacts are reduced through the best management practices described in Section 2.1 and 2.2 and the mitigation measures presented below.

## Mitigation Measures

Throughout the construction and operation of the Proposed Action several design features and best management practices would be utilized to minimize impacts to water resources as described in Sections 2.1 and 2.2 of this EA. Additional mitigation measures recommended include the following:

- Turbidity impacts to surface water resources would be reduced through the implementation of best management practices to prevent storm water pollution during all construction activities.

- At drainage crossings, additional road stabilizing measures would be required to maintain road access along the buried pipeline and reduce further channel incision, which could potentially expose the buried pipeline. Appropriately sized drainage crossings (such as culverts) would be designed and installed as appropriate
- As additional mitigation for the Propose Action, and at the request of the BLM, Intrepid has committed to stabilizing large erosional features near IP-302.
- In the event of a pipeline leak, Intrepid would contain and clean up the spill area in accordance with the permit conditions stated in Discharge Permit DP 1681 and other applicable BLM or State requirements.
- The current monitoring well network depicted on **Map EA-19 – Current HB Solar Solution Mine Monitoring Well Network** illustrates the monitoring well network would continue to be sampled as required by Discharge Permit DP 1681, Intrepid would continue to provide BLM with a dataset with which to evaluate observed drawdown and groundwater chemistry trends. The position of intermediate monitoring wells between the North Rustler well field and the monitored cave and karst areas allows measurement and evaluation of drawdown well before potential drawdown would occur at the monitored cave and karst sites and serves as an “early warning system”. Using this system, adaptive measures can be considered prior to seeing unacceptable drawdown in groundwater levels in monitored caves and karsts.
- If observed drawdown exceeds the groundwater model predictions presented in the HB EIS the mitigation presented in the adaptive management plan will be followed.

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### **3.2.4. Impacts from Alternative**

#### **Direct and Indirect Impacts**

Under the Alternative, the impacts to surface water resources would be similar to those described for the Proposed Action. The only difference is the amount of disturbance in each subwatershed. The impact to groundwater resources is identical to those described for the Proposed Action.

Under the Alternative the initial disturbance during the construction phase totals 75.0 acres, including disturbance from pipeline burial, well pad construction, and newly added power line corridors. The long-term disturbance totals 42.3 acres and represents disturbance during the operational phase of the project before final reclamation. The initial and long-term disturbance are summarized by sub-watershed in **Table 3.2-6 - Initial Disturbance in each Subwatershed for Alternative** and **Table 3.2-7 - Long-term Disturbance in each Subwatershed for Alternative**.

Half of the disturbance would occur in subwatershed Clayton Basin with lesser amounts in Nimenim Ridge and 130600110103; no disturbance would occur in Burton Flat, Little Lake or Cedar Lake Draw. Disturbance in any given subwatershed is less than or equal to 0.11% of the subwatershed area. All project disturbance is in closed basins or subwatersheds connected to closed basins.

**Table 3.2-6 Initial Disturbance in each Subwatershed for Alternative**

<b>Subwatershed (HUC-12)</b>	<b>Total Disturbed (acres)</b>	<b>% HUC-12</b>
Burton Flat	0.0	0.00
Little Lake	0.0	0.00
130600110103	14.1	0.05
Clayton Basin	25.1	0.05
Nimenim Ridge	35.8	0.11
Cedar Lake Draw	0.0	0.00
<i>Total</i>	<i>75.0</i>	<i>0.21</i>

Notes

1. Percentage of the HUC-12 was calculated using the USGS HUC Area, defined as the "area of subwatershed including non-contributing areas".
2. The disturbed area was rounded up to the nearest tenth of an acre.

Prepared By: MJH5  
Checked By: BAL3

**Table 3.2-7 Long-term Disturbance in each Subwatershed for Alternative**

<b>Subwatershed (HUC-12)</b>	<b>Total Disturbed (acres)</b>	<b>% HUC-12</b>
Burton Flat	0.0	0.00
Little Lake	0.0	0.00
130600110103	9.8	0.04
Clayton Basin	12.8	0.02
Nimenim Ridge	19.7	0.06
Cedar Lake Draw	0.0	0.00
<i>Total</i>	<i>42.3</i>	<i>0.12</i>

Notes

1. Percentage of the HUC-12 was calculated using the USGS HUC Area, defined as the "area of subwatershed including non-contributing areas".
2. The disturbed area was rounded up to the nearest tenth of an acre.

Prepared By: MJH5  
Checked By: BAL3

### 3.3. Soils

#### 3.3.1. Affected Environment

Within the project boundary, 19 soil type units are present according to the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Soil Survey Geographic Database (SSURGO) (USDA-NRCS 2014). Each soil type unit contains one or two soil components. Soil textures range from sand to clay loam and most of the soils present are deep to very deep, well drained, and formed from alluvial or residual materials derived from sedimentary rocks (BLM 2012). The soil type units and acreages contained within the project area are summarized in **Table 3.3-1 - Soil Type Within Project Boundary** and depicted in **Map EA-20 - USDA NRCS SSURGO Soils**.

Soil type unit descriptions obtained from USDA-NRCS (2014) for all soil type units present within the project boundary are provided in Appendix D for reference. Additional details regarding soil types, such as soil characteristics, are described in Section 3.4.2 of the HB EIS (BLM 2012).

Within and immediately adjacent to the project boundary, around proposed extraction well IP-302, several large erosional features are present. The approximate locations of these erosional features are shown in Map EA-20.

**Table 3.3-1 Soil Type Within Project Boundary**

<b>Soil Type</b>	<b>Acres in Project Boundary</b>	<b>Percent of Project Boundary</b>
BA: Berino loamy fine sand, 0 to 3 percent slopes	384.5	2.1%
BB: Berino complex, 0 to 3 percent slopes, eroded	2,985.4	16.3%
BD: Berino-Dune land complex, 0 to 3 percent slopes	612.9	3.3%
GA: Gypsum land	418.5	2.3%
GP: Gravel pit	18.4	0.1%
KM: Kermit-Berino fine sands, 0 to 3 percent slopes	1,365.1	7.4%
KT: Kimbrough-Stegall loams, 0 to 3 percent slopes	1,465.5	7.8%
LA: Largo loam, 1 to 5 percent slopes	1,110.3	6.1%
LS: Likes loamy fine sand, 1 to 5 percent slopes	59.5	0.3%
ML: Mined land	277.7	1.5%
PA: Pajarito loamy fine sand, 0 to 3 percent slopes, eroded	592.1	3.2%
PD: Pajarito-Dune land complex, 0 to 3 percent slopes	22.4	0.1%
PS: Potter-Simona complex, 5 to 25 percent slopes	747.5	4.1%
RG: Reeves-Gypsum land complex, 0 to 3 percent slopes	2,706.2	14.8%
RO: Rock land	59.7	0.3%
SG: Simona gravelly fine sandy loam, 0 to 3 percent slopes	458.5	2.5%
SM: Simona-Bippus complex, 0 to 5 percent slopes	4,248.9	23.2%
SR: Stony and Rough broken land	184.8	1.0%
TF: Tonuco loamy fine sand, 0 to 3 percent slopes	658.1	3.6%
<b>Total</b>	<b>18,347</b>	<b>100.0%</b>

**Notes:**

Soil types acreages are rounded up to a tenth of an acre. Therefore, the total acreage is slightly larger than the proposed project boundary acreage and the calculated total percentage is greater than 100 percent.

Prepared by: MCC2  
Checked by: BJW1

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### 3.3.2. Impacts from the No Action Alternative

#### Direct and Indirect Impacts

The No Action Alternative would deny the approval of the proposed project and would not grant permission for Intrepid to access public lands in order to expand solution mine operations to produce potash. Current land and resource used would continue under current conditions in the project area.

The large erosional features near the proposed extraction well IP-302 would likely continue to expand during high flow events and pose a hazard to nearby recreation trails. Under the No Action Alternative these features would probably remain unrepaired.

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### 3.3.3. Impacts from the Proposed Action

#### Direct and Indirect Impacts

Direct and indirect impacts to soil resources would include short-term impacts resulting from construction related activities and long-term impacts resulting from the presence of permanent facilities during the operation of the Proposed Action. Impacts to soil from the Proposed Action would be similar to the soil impacts for the existing HB Solar Solution Mine as described in Section 4.4 of the HB EIS (BLM 2012). Short-term impacts would include increased potential erosion due to the removal of vegetation during construction activities, compaction of the soils during heavy equipment usage, disruption of soil biological processes as the soil layers are altered during site trenching and site grading, and effects from accidental spills of fuel and lubricants. Long-term impacts would include increased runoff and erosion along the pipeline maintenance road, and soil contamination from accidental pipeline leakage. To avoid and minimize the potential for these impacts, mitigation has been developed and is described in the mitigation section below.

Construction activities associated with trenching of the proposed pipelines, installation of the injection and extraction well pads, installation of the booster pump station, and installation of overhead power-runs to well heads, as described in Section 2.2, would directly impact approximately 84.5 acres of soil resources. Approximately 33.8 acres is already disturbed and 27.8 acres is immediately adjacent to current disturbed areas. Direct construction impacts to soils are summarized in **Table 3.3-2 - Proposed Action Construction Soil Type Disturbances**.

**Table 3.3-2 Proposed Action Construction Soil Type Disturbances**

<b>Soil Type</b>	<b>Total Disturbance (acres)</b>	<b>New Area Disturbance (acres)</b>	<b>Within Prior Disturbed Area Disturbance (acres)</b>
BB: Berino complex, 0 to 3 percent slopes, eroded	15.1	12.0	3.1
GA: Gypsum land	1.3	0.0	1.3
KM: Kermit-Berino fine sands, 0 to 3 percent slopes	6.0	6.0	0.0
LA: Largo loam, 1 to 5 percent slopes	10.7	4.1	6.6
LS: Likes loamy fine sand, 1 to 5 percent slopes	1.7	1.7	0.0

<b>Soil Type</b>	<b>Total Disturbance (acres)</b>	<b>New Area Disturbance (acres)</b>	<b>Within Prior Disturbed Area Disturbance (acres)</b>
PA: Pajarito loamy fine sand, 0 to 3 percent slopes, eroded	6.3	0.9	5.5
PS: Potter-Simona complex, 5 to 25 percent slopes	10	7.5	2.5
RG: Reeves-Gypsum land complex, 0 to 3 percent slopes	6.7	0.0	6.7
SG: Simona gravelly fine sandy loam, 0 to 3 percent slopes	5.3	5.3	0.0
SM: Simona-Bippus complex, 0 to 5 percent slopes	19.3	11.2	8.1
SR: Stony and Rough broken land	2.0	2.0	0.0
<b>Total</b>	<b>84.5</b>	<b>50.7</b>	<b>33.8</b>

Soil types acreages are rounded up to a tenth of an acre. Slight variations between the total disturbance acres presented in this table and total disturbance acres presents for other resources for similar analyses is due to variations within the various resources datasets used for analysis.

Prepared by: MCC2  
Checked by: BJW1

The operation of Proposed Action system components and infrastructure, as described in Section 2.2, would directly impact approximately 47.1 acres of soil resources. Approximately 17.6 acres is already disturbed and 13.8 acres is immediately adjacent to disturbed areas. Direct operational impacts to soil resources are summarized in **Table 3.3-3 – Proposed Action Operations Soil Type Disturbances**.

**Table 3.3-3 Proposed Action Operations Soil Type Disturbances**

<b>Soil Type</b>	<b>Total Disturbance (acres)</b>	<b>New Area Disturbance (acres)</b>	<b>Within Prior Disturbed Area Disturbance (acres)</b>
BB: Berino complex, 0 to 3 percent slopes, eroded	8.2	6.6	1.6
GA: Gypsum land	0.7	0.0	0.7
KM: Kermit-Berino fine sands, 0 to 3 percent slopes	3.0	3.0	0.0
LA: Largo loam, 1 to 5 percent slopes	6.7	2.9	3.8
LS: Likes loamy fine sand, 1 to 5 percent slopes	1.4	1.4	0.0

<b>Soil Type</b>	<b>Total Disturbance (acres)</b>	<b>New Area Disturbance (acres)</b>	<b>Within Prior Disturbed Area Disturbance (acres)</b>
PA: Pajarito loamy fine sand, 0 to 3 percent slopes, eroded	3.2	0.5	2.7
PS: Potter-Simona complex, 5 to 25 percent slopes	5.8	4.5	1.3
RG: Reeves-Gypsum land complex, 0 to 3 percent slopes	3.5	0.0	3.5
SG: Simona gravelly fine sandy loam, 0 to 3 percent slopes	2.9	2.9	0.0
SM: Simona-Bippus complex, 0 to 5 percent slopes	10.4	6.4	4.0
SR: Stony and Rough broken land	1.3	1.3	0.0
<b>Total</b>	<b>47.1</b>	<b>29.5</b>	<b>17.6</b>

Soil types acreages are rounded up to a tenth of an acre. Slight variations between the total disturbance acres presented in this table and total disturbance acres presents for other resources for similar analyses is due to variations within the various resources datasets used for analysis.

Prepared by: MCC2  
Checked by: BJW1

## Mitigation Measures

Throughout the construction and operation of the Proposed Action, several best management practices would be utilized to minimize impacts to soil resources as described in Section 2.2 of this EA. Additional mitigation measures recommended include the following:

- Regular monitoring of reclaimed areas along with maintenance or reseeding as needed.
- Periodic inspection for erosion around the constructed infrastructure and ROWs. If erosion is noted, erosion control measures would be evaluated and implemented as appropriate.

### 3.3.4. Impacts from Alternative

#### Direct and Indirect Impacts

Direct and indirect soil impacts associated with the alternative proposed pipeline route and subsequent operation of the Alternative Action would remain consistent with the impacts described for the Proposed Action, with the exception of the number of disturbed soil acres.

Construction activities associated with trenching of the alternative route pipelines, installation of the injection and extraction well pads, installation of the booster pump station, and installation of overhead power-runs to well heads, as described in Section 2.2, would directly impact approximately 75.2 acres of soil resources. Approximately 43.6 acres is already disturbed. Direct construction impacts to soil are summarized in **Table 3.3-4 - Alternative Construction Soil Type Disturbances**.



**Table 3.3-4 Alternative Construction Soil Type Disturbances**

<b>Soil Type</b>	<b>Total Disturbance (acres)</b>	<b>New Area Disturbance (acres)</b>	<b>Within Prior Disturbed Area Disturbance (acres)</b>
BB: Berino complex, 0 to 3 percent slopes, eroded	8.4	5.1	3.3
GA: Gypsum land	1.3	0.0	1.3
LA: Largo loam, 1 to 5 percent slopes	10.8	4.1	6.7
LS: Likes loamy fine sand, 1 to 5 percent slopes	1.7	1.7	0.0
ML: Mined land	3.8	0.0	3.8
PA: Pajarito loamy fine sand, 0 to 3 percent slopes, eroded	5.5	0.0	5.5
PS: Potter-Simona complex, 5 to 25 percent slopes	8.7	2.4	6.3
RG: Reeves-Gypsum land complex, 0 to 3 percent slopes	6.7	0.0	6.7
SG: Simona gravelly fine sandy loam, 0 to 3 percent slopes	3.0	3.0	0.0
SM: Simona-Bippus complex, 0 to 5 percent slopes	23.3	13.3	10.0
SR: Stony and Rough broken land	2.0	2.0	0.0
<b>Total</b>	<b>75.2</b>	<b>31.6</b>	<b>43.6</b>

Soil types acreages are rounded up to a tenth of an acre. Slight variations between the total disturbance acres presented in this table and total disturbance acres presents for other resources for similar analyses is due to variations within the various resources datasets used for analysis.

Prepared by: MCC2  
Checked by: BJW1

Following construction, the operation of Alternative Action system components and infrastructure, as described in Section 2.2, would directly impact approximately 42.3 acres of soil resources. Approximately 21.3 acres is already disturbed. Direct operational impacts to soil resources are summarized in **Table 3.3-5 - Alternative Operations Soil Type Disturbances.**

**Table 3.3-5 Alternative Operations Soil Type Disturbances**

<b>Soil Type</b>	<b>Total Disturbance (acres)</b>	<b>New Area Disturbance (acres)</b>	<b>Within Prior Disturbed Area Disturbance (acres)</b>
BB: Berino complex, 0 to 3 percent slopes, eroded	4.7	3.0	1.7
GA: Gypsum land	0.7	0.0	0.7
LA: Largo loam, 1 to 5 percent slopes	6.6	3.7	2.9
LS: Likes loamy fine sand, 1 to 5 percent slopes	1.5	1.5	0.0

<b>Soil Type</b>	<b>Total Disturbance (acres)</b>	<b>New Area Disturbance (acres)</b>	<b>Within Prior Disturbed Area Disturbance (acres)</b>
ML: Mined land	1.9	0.0	1.9
PA: Pajarito loamy fine sand, 0 to 3 percent slopes, eroded	2.7	0.0	2.7
PS: Potter-Simona complex, 5 to 25 percent slopes	5.0	2.0	3.0
RG: Reeves-Gypsum land complex, 0 to 3 percent slopes	3.5	0.0	3.5
SG: Simona gravelly fine sandy loam, 0 to 3 percent slopes	1.9	1.9	0.0
SM: Simona-Bippus complex, 0 to 5 percent slopes	12.5	7.6	4.9
SR: Stony and Rough broken land	1.3	1.3	0.0
<b>Total</b>	<b>42.3</b>	<b>21.0</b>	<b>21.3</b>

Soil types acreages are rounded up to a tenth of an acre. Slight variations between the total disturbance acres presented in this table and total disturbance acres presents for other resources for similar analyses is due to variations within the various resources datasets used for analysis.

Prepared by: MCC2  
Checked by: BJW1

## 3.4. Air Quality

### 3.4.1. Affected Environment

The Proposed Action in Eddy County is located in the Pecos-Permian Basin Interstate Air Quality Control Region (AQCR) 155. Generally, this AQCR includes areas known as the Southern High Plains and the Middle Pecos River drainage basin. The total area of the AQCR is 23,749 square miles. The landscape is predominantly plains or rolling hills, although the southwestern part of the region is somewhat mountainous. Elevation ranges from 2,900 ft where the Pecos River flows into Texas to above 7,000 ft in the mountains of the southwest. Vegetation is generally grassland dotted with yucca, mesquite, or cholla; small piñon-juniper forests are found in the northern part of the region and near the Guadalupe, Sacramento, and Capitan Mountains along the southwestern border of the region. AQCR 155 also contains the most extensive areas of croplands in New Mexico.

Productive farm and rangeland, extensive oil and natural gas deposits, and potash are the major natural resources of AQCR 155. Most irrigated farming occurs along the Pecos River in lower Chaves and Eddy Counties and along the eastern border with Texas in Quay, Curry, Roosevelt, and Lea Counties. Some dryland farming is also done in this latter area (NMED 2015).

Mean monthly temperatures in the region range from 37.4°F in January to 79.7°F in July. Average annual precipitation ranges from 11.5 inches in Eddy County to 16.8 inches in Curry and Roosevelt Counties. Approximately 75% of the total precipitation falls between April and September (Powers et al. 1978). Pan evaporation is around 110 inches per year, about 73 inches of evaporation occurs from May to October over the entire area. The measured potential evaporation rates far exceed the average annual precipitation (Powers et al. 1978).

Average wind speeds are about 11 miles per hour. A wind rose available from the NMED that represents surface data for nearby Artesia, New Mexico indicates that the predominant wind direction for the area is from the southwest (NMED 2015).

## Existing Air Quality

Existing air quality is presented in Section 3.5 of the EIS and excerpts are included below. Air quality is influenced by the regional climate, soil, terrain, and ongoing activities in the area. The Proposed Action is in an area classified as a Class II air quality area. Emission sources that contribute to air quality in the project area are from biogenic sources, motorized equipment, and windblown dust. Particulates from nearby oil and gas production, agricultural burning, recreational and industrial vehicular traffic, and ambient air dust can also affect air quality.

Air quality in the area near the Proposed Action is considered good, and USEPA designates Eddy County as being in attainment or unclassified with respect to the National Ambient Air Quality Standards (NAAQS) for ozone (O<sub>3</sub>), carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>), sulfur dioxide (SO<sub>2</sub>), Particulate Matter < 10 microns (PM<sub>10</sub>), Particulate Matter < 2.5 microns (PM<sub>2.5</sub>), and lead.

The NMED Air Quality Bureau (aqb) conducts monitoring of ambient concentrations of pollutants throughout the State. The USEPA summarizes ambient air quality at specific monitoring locations in terms of multi-year averages. The most often used term is the design value, which is a statistic that describes the air quality status of a given location relative to the level of the NAAQS. **Table 3.4-1 - Design Values for Criteria Pollutants in Lea, Chaves, and Eddy Counties, 2011-2013** shows design values for O<sub>3</sub>, NO<sub>2</sub>, and particulate matter at locations in Eddy County, as well as locations in nearby Lea and Chaves Counties. All design values are below the applicable NAAQS (USEPA 2015).

**Table 3.4-1 Design Values for Criteria Pollutants in Lea, Chaves, and Eddy Counties, 2011-2013**

Criteria Pollutant	Averaging Period	NAAQS	Carlsbad	Carlsbad Caverns National Park	Hobbs
O <sub>3</sub> (ppm)	8-hour	0.075	0.071	0.070	0.066
PM <sub>2.5</sub> (µg/m <sup>3</sup> )	24-hour	35	--	--	22
	Annual	12	--	--	8.4
PM <sub>10</sub> (µg/m <sup>3</sup> )	24-hour	150	--	--	100
NO <sub>2</sub> (ppb)	1-hour	100	--	--	
	Annual	53	--	--	

**Notes:**

µg/m<sup>3</sup>: micrograms per cubic meter

ppb: parts per billion

Prepared by: CED1

Checked by: BAL3

The Proposed Action will not add any new sources of air emissions subject to NMED air permitting requirements.

Air emissions from the HB Plant (i.e., milling and refining processes, material handling operations and haul road activities associated with the HB Solar Solution Mine) are permitted under an NMED AQB New Source Review (NSR) Permit (NMED AQB 2013). The air permit sets limits for emissions from point sources as well as sources of fugitive dust. Fugitive dust sources include material handling operations and paved and unpaved haul roads.

In addition to the HB Plant Intrepid operates the North and West Plants. Air emissions for these three facilities are aggregated for the purpose of Clean Air Act Title V permitting, and the potential air emissions from the facilities are provided in **Table 3.4-2 - Total Potential Pollutant Emissions from Entire Facility**.

Emissions of hazardous air pollutants are stated to be less than one ton per year for all three facilities.

**Table 3.4-2 Total Potential Pollutant Emissions from Entire Facility**

<b>Pollutant</b>	<b>Emissions – HB Plant Only (tpy)</b>	<b>Emissions – HB, North, and West Plants (tpy)</b>
Nitrogen Oxides (NO <sub>x</sub> )	15.1	72.4
Carbon Monoxide (CO)	12.7	186.9
Volatile Organic Compounds (VOC)	0.8	4.6
Total Suspended Particulates (TSP)	89.7	426.14
Particulate Matter < 10 microns (PM <sub>10</sub> )	29.7	243.43
Particulate Matter < 2.5 microns (PM <sub>2.5</sub> )	12.5	197.67
Sulfur Dioxide (SO <sub>2</sub> )	0.4	1.8
Greenhouse Gases (GHG)	< 100,000	< 100,000

Source: Intrepid Potash, Barbara Hodgson, Environmental Manager, March 25, 2015.

The HB Plant and the “new” North Plant currently operate under separate NSR permits. The West Plant operates under a Title V permit. These permits require Intrepid to follow certain requirements to demonstrate continued compliance with NAAQS and New Mexico Ambient Air Quality Standards (NMAAQS). Intrepid has applied for an amendment of the existing Title V air permit that would include the air permit requirements for the HB Plant and the “new” North Plant.

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### ***3.4.2. Impacts from the No Action Alternative***

#### **Direct and Indirect Impacts**

Under the No Action Alternative, the Proposed Action would not be developed, and the associated air quality impacts would not occur. Under this alternative, the existing HB Solar Solution Mine and associated HB Plant would continue to operate under current permits and authorizations.

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### ***3.4.3. Impacts from the Proposed Action***

#### **Direct and Indirect Impacts**

Direct impacts associated with the Proposed Action would include air emissions from activities associated with construction of the new pipeline to support injection and extraction operations at the AMAX Mine as well as during ongoing operations. Construction activities are expected to generate fugitive dust during construction of access roadways to the pipelines, excavation of trenches for installation of pipelines, and backfill of soil into the trench once the pipeline installation is completed. Windblown dust may be expected for a short period of time from removed soil stored adjacent to the trench. Fugitive dust may also be generated during installation of injection and extraction wells, and installation of a booster pump station. In addition, providing overhead power to support the Proposed Action wells and booster pump station may involve minor excavation activities and movement of materials that may disturb soil during the construction process. Procedures would be developed to minimize potential effects associated with these activities and are described below in the mitigation section.

Combustion emissions would occur from mobile vehicles and ancillary equipment that are used to install the pipeline for the Proposed Action. Mobile vehicles would include trucks, excavators and other mobile equipment used during the construction activities. Combustion emissions would also occur from equipment such as trucks and drill rigs used during drilling and installation of the four injection and extraction wells. While combustion emissions associated with the construction activities have not been quantified, they could be expected to be similar or less than those identified in the EIS for construction of the HB Solar Solution Mine facilities (Section 3.5 of the HB EIS, BLM 2012).

Once construction is completed, the primary sources of airborne emissions are expected to be from fugitive dust and vehicle emissions associated with occasional vehicles that would travel on access roads to inspect and service equipment associated with the Proposed Action. There would be no new point sources of emissions, such as stacks for processing operations. Given the actual process only involves movement of liquid through wells and pipelines, airborne emissions from actual processing of the brine should be minimal. No volatile Hazardous Air Pollutants (HAP) are associated with the Proposed Action and its operations.

Operations at the HB Plant and facilities would continue to support the existing solution mining activities as well as new activities associated with the Proposed Action. No changes are planned in the HB Plant process rate or other operations at the site that would affect airborne emissions of criteria pollutants from those operations.

During NSR permitting of the HB Plant, air dispersion modeling was performed to assess the potential impact to the NAAQS and NMAAQs at the facility boundary. Results are shown in the following **Table 3.4-3 - Summary of NAAQS Modeling Results, HB Mill Point and Fugitive Emissions**. Results show that facility-wide emissions, when adjusted for assigned background levels, were expected to be in compliance with all ambient air quality limits based on maximum capability to operate the equipment. Impacts from actual operations are expected to be less in that equipment typically operates at levels below the maximum design level. The maximum predicted impacts for the CO 1-hour and 8-hour averaging periods were below the modeling impact levels, therefore, CO modeling was not required.

**Table 3.4-3 Summary of NAAQS Modeling Results, HB Mill Point and Fugitive Emissions**

Pollutant	Averaging Period	Modeled Results ( $\mu\text{g}/\text{m}^3$ )	Background ( $\mu\text{g}/\text{m}^3$ )	Modeled Results with Background ( $\mu\text{g}/\text{m}^3$ )	NAAQS ( $\mu\text{g}/\text{m}^3$ )	NMAAQs
NO <sub>2</sub>	Annual	2.4	—	2.4	100	0.050 ppm
	24-hour	10.8	—	10.8	—	0.10 ppm
PM <sub>2.5</sub>	Annual	1.7	7.3	9.0	15	—
	24-hour	8.3	7.3	15.6	35	—
PM <sub>10</sub>	Annual	5.1	20.0	25.1	—	—
	24-hour	17.6	20.0	37.6	150	—
TSP	Annual	18.2	26.6	44.8	—	60 $\mu\text{g}/\text{m}^3$
	24-hour	58.6	26.6	85.3	—	150 $\mu\text{g}/\text{m}^3$

Notes:

Modeled results rounded to one-tenth micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ).

NO<sub>2</sub>: Nitrogen dioxide

Prepared by: CED1

Checked by: BAL3

The primary sources of particulate matter emissions were from unpaved and paved haul roads fugitive sources used for harvesting KCl from the solar evaporation ponds and hauling potash concentrate to the North Plant for compaction. Fugitive emissions from access roads associated with the HB Solar Solution Mine (pipelines and injection/extraction wells) were not included in dispersion modeling, as these sources of emissions are not subject to NMED air permitting. A copy of the Ambient Air Quality Modeling Report to support the air permit application is included as Appendix E, Air Dispersion Modeling.

It is expected that additional activities on the new access roads associated with the Proposed Action would not adversely impact ambient air quality levels given the smaller number of disturbed acres. In addition the access roads to the pipelines and associated equipment for the Proposed Action would only

be used periodically to service and inspect equipment and would typically be used by light trucks. Therefore, expected fugitive dust emissions from access roads would be less than for haul roads used in operations.

Permits stipulate use of certain control equipment to minimize pollutant emissions and rely on mitigation to verify ongoing compliance with requirements. For example, at the HB Solution Mine and Mill, the facility controls fugitive dust from unpaved haul roads by applying a cover of base course or gravel to control particulate emissions. The facility would need to verify the frequency, quantity, and locations of the applications and assess the effectiveness of the applications to minimize visible dust.

Air dispersion modeling was also performed to determine potential impacts of the HB Plant at the nearby Living Desert State Park. Modeled results indicated that airborne concentrations are well below both Class I and Class II modeling significance levels. The highest-first-high short-term and highest annual average modeled values are presented in **Table 3.4-4 – Summary of Modeled Results for Living Desert State Park** along with background values and significance levels. It is therefore expected that fugitive emissions from the Proposed Action should also be well below these levels (Section 3.5 of the HB EIS, BLM 2012).

**Table 3.4-4 Summary of Modeled Results for Living Desert State Park**

Pollutant	Averaging Period	Modeled Results ( $\mu\text{g}/\text{m}^3$ )	Class II Modeling Significance Levels ( $\mu\text{g}/\text{m}^3$ )	NAAQS ( $\mu\text{g}/\text{m}^3$ )	NMAAQS
CO	8-hour	0.1	500	10,000	8.7 ppm
	1-hour	0.7	2,000	40,000	13.1 ppm
NO <sub>2</sub>	Annual	0.0	1.0	100	0.050 ppm
	24-hour	0.0	5.0	—	0.10 ppm
	1-hour	1.0	5.0	188	—
PM <sub>2.5</sub>	Annual	0.0	0.3	15	—
	24-hour	0.0	1.2	35	—
PM <sub>10</sub>	Annual	0.0	1.0	—	—
	24-hour	0.1	5.0	150	—
TSP	Annual	0.0	1.0	—	60 $\mu\text{g}/\text{m}^3$
	24-hour	0.2	5.0	—	150 $\mu\text{g}/\text{m}^3$

Notes:  
Modeled results rounded to one-tenth micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ).

Prepared by: CED1  
Checked by: BAL3

## Mitigation Measures

To mitigate fugitive dust emissions during construction activities, a water truck would be available to wet traffic areas as pipelines are being installed along the proposed route. Similarly, water would be used to wet down areas during installation of injection and extraction wells and the booster pump station. Use of water during these activities should minimize fugitive dust generated during these operations. A coarser gravel material may be applied in certain higher traffic locations to minimize dust generation from the roadways.

Additional mitigation measures include development of a dust control plan prior to the start of construction activities. The dust control plan would provide more details on how dust suppression methods would be used, such as water application to access roads and other disturbed areas or chemical dust suppressant

application where appropriate, according to accepted and reasonable industry practice. To the extent practicable, Intrepid would use equipment that meets USEPA's Highway Diesel and Non-road Diesel Rules for project construction and maintenance operations to reduce the potential impact from combustion emissions associated with the equipment used for the Proposed Action.

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### **3.4.4. Impacts from Alternative**

#### **Direct and Indirect Impacts**

The Alternative would involve a different pipeline route, but would otherwise be similar to the Proposed Action. During the construction process, the total disturbed acres would be slightly less than the Proposed Action. However, it should be noted that while much of the pipeline for the Proposed Action would follow disturbed areas where existing pipelines are located, a larger portion of the pipeline installation for the Alternative would be on undisturbed area (see Map EA-3). As a result, the amount of new disturbed area would be greater.

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## **3.5. Climate Change**

### **3.5.1. Affected Environment**

Greenhouse gases (GHG) consist of compounds in the earth's atmosphere that absorb outgoing long-wave radiation emitted from the earth's surface, resulting in a warming of the atmosphere. Naturally occurring greenhouse gases include water vapor, carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), and O<sub>3</sub>. Human activities also result in the release of GHG including several compounds containing fluorine, chlorine, or bromine that result, for the most part, from industrial activities. Through a natural carbon cycle, CO<sub>2</sub> is absorbed by the oceans and by living biomass through plant photosynthesis, and then released to the atmosphere through natural processes (USEPA 2008).

In the U.S., the primary source of anthropogenic GHG emissions is fossil fuel combustion. Fossil fuel combustion accounted for 80 percent of 2008 GHG emissions (USEPA 2010). Fossil fuels are responsible for supplying approximately 85 percent of U.S. primary energy needs and approximately 98 percent of estimated anthropogenic CO<sub>2</sub> emissions. N<sub>2</sub>O is also a product of fossil fuel combustion but is largely accounted for as a byproduct of agricultural practices; methane is emitted by petroleum production operations (USEPA 2008). The U.S. released approximately 5921.2 million metric tons of CO<sub>2</sub> into the atmosphere in 2008. Of this total, approximately 30.0 million metric tons were released from natural gas systems (USEPA 2010).

According to the NMED, emissions of GHGs remained essentially level from 2000 to 2007, despite a 6.7% growth in New Mexico's population over that period. The largest sources of GHG emissions in 2007 were electricity production (41%), the fossil fuel industry (22%), and transportation fuel use (20%), which remains consistent with estimation for the years 1990 and 2000 (BLM 2014a).

It is estimated that approximately 17.3 million metric tons of GHGs from the natural gas industry and 2.3 million metric tons of GHGs from the oil industry were projected in 2010 as a result of oil and natural gas production, processing, transmission, and distribution (Center for Climate Strategies 2006). It is estimated that 0.01% of U.S. total GHG emissions are produced by oil and gas production in the Permian Basin (BLM 2014a).

Preliminary GHG emissions inventories have been prepared for each State in a cooperative effort between the Center for Climate Strategies and the environmental departments for each State. According to the inventory for New Mexico the GHG emissions for reporting year 2000 were 83 million metric tons of carbon dioxide equivalents (CO<sub>2</sub>e). For any quantity and type of greenhouse gas, CO<sub>2</sub>e signifies the amount of CO<sub>2</sub> which would have the **equivalent** global warming impact. A quantity of GHG can be

expressed as CO<sub>2</sub>e by multiplying the amount of the GHG by its Global Warming Potential (GWP). The reference case GHG emissions for year 2020 were estimated at 102 million metric tons of CO<sub>2</sub>e (Center for Climate Strategies 2006).

For 2011, GHG emissions in Chaves, Eddy, and Lea counties in New Mexico from fires (both wildfires and man-made) and mobile sources were estimated at 1,434,260 metric tons CO<sub>2</sub>e. For the same year, industrial sources in Chaves, Eddy, and Lea Counties reported emitting 5,811,875 metric tons CO<sub>2</sub>e (BLM 2014b). Total GHG emissions for the three counties are 7,246,135 metric tons CO<sub>2</sub>e.

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### ***3.5.2. Impacts from the No Action Alternative***

#### **Direct and Indirect Impacts**

Under the No Action Alternative, the Proposed Action would not be developed, and any associated climate change impacts would not occur. Under this alternative, Intrepid's existing HB Solar Solution Mine facility would continue to operate as currently configured. GHG emissions from existing operations would continue as presently estimated.

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### ***3.5.3. Impacts from the Proposed Action***

#### **Direct and Indirect Impacts**

The primary sources of GHG emissions from the Proposed Action would be from vehicle and equipment emissions during the construction phase and to a lesser extent during operations. During construction, vehicles and equipment would include construction vehicles such as light and heavy trucks, excavators, motor graders, drilling rigs, and other support equipment. Construction activities would include trenching of proposed pipelines, installation of the injection and extraction well pads, wells, and well heads, installation of the booster pump station, and installation of overhead power lines for the booster pump and wells. Associated access roads would also be constructed during this phase.

During operations, light duty vehicles such as pickup trucks would be used to periodically conduct inspections and maintenance on the pipeline extension and well heads. In addition to the above, there may be a slight increase in GHG emissions through use of additional electricity to operate the booster pump and extraction well pumps.

While annual GHG CO<sub>2</sub>e emissions have not been estimated for this project, during preparation of the EIS, the estimated annual electrical usage for existing operations and the Proposed Action were expected to result in a range of 114,449 to 133,979 metric tons of GHG CO<sub>2</sub>e per year. For the same operations, mobile sources at the facility were expected to contribute up to 5,411 metric tons per year GHG CO<sub>2</sub>e from diesel combustion, while the gasoline combustion was estimated to contribute up to 924 metric tons per year.

During construction activities, the estimated GHG CO<sub>2</sub>e contributions from combined diesel and gasoline combustion were estimated to be 20,986 metric tons for the entire project (BLM 2012).

While the contributions from electrical use and vehicle fuel combustion have not been estimated for operations at the Proposed Action, it is projected to be minimal. Additional electricity use would be at the booster station and at the two injection and extraction wells for the Proposed Action. Once construction is completed, the use of vehicles would be limited to periodic inspections and maintenance activities for the pipeline, the booster pump station, and injection and extraction wells.

#### **Mitigation Measures**

Climate change mitigation measures would include the implementation of process and energy efficiency programs. As it is in the best interest of Intrepid to conduct operations in an efficient manner to facilitate fuel conservation, process and energy efficiency methods would be incorporated into operational



practices where prudent. This may include use of energy efficient equipment and newer vehicles that meet the most stringent USEPA mobile vehicle standards.

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### **3.5.4. Impacts from Alternative**

#### **Direct and Indirect Impacts**

Impacts associated with the Alternative would be similar to the Proposed Action.

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## **3.6. Vegetation**

### **3.6.1. Affected Environment**

Within the project area the vegetation of interest includes native vegetation, noxious and invasive weeds, and special status plant species. The following details these and how they relate to the Proposed Project.

The project area is located within the Chihuahuan Desert ecoregion, which is composed of two subregions: the Chihuahuan Basins and Playas and Chihuahuan Desert Grasslands. The Chihuahuan Desert ecoregion historically has been dominated by desert grasslands and shrublands with shrublands becoming more dominant over the last several hundred years. The transition from grasslands to shrublands is believed to be primarily the result of cattle grazing activities (NMSU 2013). The Chihuahuan Basins and Playas subregion is located mostly below 4,500 ft amsl with Chihuahuan Desert Grasslands found at higher elevations, such as elevated basins between mountain ranges, low mountain benches and plateau tops. Both the Chihuahuan and Playas subregions are extremely arid, however, the Chihuahuan Desert Grasslands have higher annual precipitation than the Chihuahuan Basins and Playas. The dominant cover types within the project area are: Desert Scrub, Mesquite Upland Scrub, and Grasslands. The following descriptions of dominant cover types are excerpts from the EIS.

Desert scrub is the most common cover type in the project area and is found in combination with the Mesquite Upland Scrub vegetation cover type throughout the majority of the project area. It is composed of several land cover types: the Chihuahuan Creosotebush Xeric Basin Desert Scrub, the Chihuahuan Mixed Desert and Thorn Scrub, and Chihuahuan Mixed Salt Desert Scrub. The Chihuahuan Creosotebush Xeric Basin Desert Scrub landcover type occurs in xeric basins and plains, the Chihuahuan Mixed Desert and Thorn Scrub is found in the transition zone between the foothills and lower montane woodlands, and the Chihuahuan Mixed Salt Desert Scrub occurs in saline basins, alluvial flats and around playas. Vegetation consists of creosotebush often found with other desert scrub species such as American tarwort (tarbush) (*Flourensia cernua*), catclaw mimosa (*Mimosa aculeaticarpa* var. *biuncifera*), junipers (*Juniperus* spp.), honey mesquite (*Prosopis glandulosa*), and plumed crinklemat (*Tiquilia greggii*). In the Chihuahuan Mixed Salt Desert Scrub areas, the dominant shrub species tend to be salt tolerant such as fourwing saltbush (*Atriplex canescens*) and other atriplex species (*Atriplex* spp.) associated with the above shrub species. Herbaceous species have lower cover than shrubs in these areas and common species include side-oats grama (*Bouteloua curtipendula*), black grama (*Bouteloua eriopoda*), bush muhly (*Muhlenbergia porter*), Tobosagrass (*Pleuraphis mutica*), Plains bristlegrass (*Setaria* spp.), Plains lovegrass (*Eragrostis intermedia*), and alkali sacaton (*Sporobolus airoides*).

The Mesquite Upland Scrub cover type is the second most dominant vegetation cover type and is found in combination with Desert Scrub throughout the majority of the project area. It is composed of upland shrublands and is typically found in the transition zone of foothills and piedmonts of the Chihuahuan Desert Ecoregion. It is typically found on alluvium derived substrates that are often gravelly. Vegetation is typically dominated by shrubs with little grass cover. The deep-rooted shrubs are able to exploit the deep soil moisture that is unavailable to grasses and cacti. Species include honey mesquite, littleleaf sumac, soapberry (*Sapindus* spp.) and other succulent species. Desertification has increased the extent of Mesquite Upland Scrub.

The Grassland cover type is found on a broad range of geologic areas and soil types. It is the third most common vegetation cover type, and is found on the western side of the project area. It occurs on alluvial fans, flats, slopes and basins, sandy plains and sandstone mesas. It is found on moderate to deep soils; gypsum outcrops; sandy gypsiferous and/or alkaline soils; sandy to clayey loamy, ustic soils; and soils with high sand content. The vegetated cover is typically dominated by graminoids with an open shrub layer. Graminoid species include blue grama, needle-and-thread grass (*Hesperostipa comata*), alkali sacaton, gypsum grama (*Bouteloua breviseta*), purple threeawn (*Aristida purpurea*), side-oats grama, sand dropseed (*Sporobolus cryptandrus*), hairy grama (*Bouteloua hirsuta*), and black grama (*Bouteloua eriopoda*). Shrubs and dwarf shrubs include sand sagebrush (*Artemisia filifolia*), fourwing saltbush, honey mesquite, soap tree yucca, crinklemat species (*Tiquilia* spp.), broom snakeweed, Torrey's jointfir, Apache plume (*Fallugia paradoxa*), and Torrey's yucca (*Yucca torreyi*). The vegetative cover is influenced by the underlying soil type. Sandy soils have higher cover of spike dropseed, soap tree yucca, and needle-and-thread grasses; while gypsum soils are dominated by gypsophilous plants such as gypsum grama.

Vegetation types and acreages contained within the project boundary were analyzed using the Southwest Regional Gap Analysis Project (SWReGAP) Land Cover data (USGS 2004). Vegetation types present within the project boundary are depicted in **Map EA-21 - Land Cover**. Vegetation types and acreages for each type are summarized in **Table 3.6-1 - Land Cover Type Within Project Boundary**. Land cover type descriptions obtained from NatureServe (2004) for all cover types present within the Proposed Project boundary are provided in Appendix F for reference.

**Table 3.6-1 Land Cover Type Within Project Boundary**

<b>Land Cover Type</b>	<b>Acres in Project Boundary</b>	<b>Percent of Project Boundary</b>
Apacherian-Chihuahuan Mesquite Upland Scrub	8,715.1	47.5%
Apacherian-Chihuahuan Piedmont Semi-Desert Grassland and Steppe	161.5	0.9%
Chihuahuan Creosotebush, Mixed Desert and Thorn Scrub	7,165.6	39.1%
Chihuahuan Gypsophilous Grassland and Steppe	142.2	0.8%
Chihuahuan Mixed Salt Desert Scrub	202.8	1.1%
Chihuahuan Sandy Plains Semi-Desert Grassland	146.8	0.8%
Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub	57.5	0.3%
North American Arid West Emergent Marsh	3.2	0%
North American Warm Desert Active and Stabilized Dune	1.6	0%
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	9.7	0.1%
North American Warm Desert Riparian Woodland and Shrubland	125.1	0.7%
North American Warm Desert Wash	11	0.1%
Open Water	345.2	1.9%
Western Great Plains Saline Depression Wetland	184.7	1.0%
Western Great Plains Sandhill Shrubland	799.1	4.4%
Western Great Plains Shortgrass Prairie	275.9	1.5%
<b>Total</b>	<b>18,347</b>	<b>100.2%</b>

Notes:

Land cover type acreages are rounded up to a tenth of an acre. Therefore, the total acreage is slightly larger than the proposed project boundary acreage and the calculated total percentage is greater than 100 percent.

Prepared by: MCC2  
Checked by: BJW1

### **Noxious and Invasive Weeds**

A noxious and invasive weeds survey was conducted by qualified biologists along the proposed and alternative pipeline routes, the well sites, and within 200 meters of the proposed ROW on

February 18 and 19, 2015. No noxious weeds were identified during the surveys. However, African Rue has been observed and/or sprayed within the proposed HB AMAX Solution Mine Extension Project boundary as indicated on Map EA-21. *Lepidium* and *Phacelia* were found in abundance during the surveys at the locations shown on Map EA-21. A survey narrative, datasheets, photos, and a map showing locations of the survey observations are provided in Appendix G.

### **Special Status Plant Species**

As described in Section 3.7.2 of the HB EIS (BLM 2012), a number of special status plant species have previously been evaluated for potential occurrence within and around the project area. The EIS analysis identified two species as having a potential to occur within and around the project area. As indicated by BLM (2012) Scheer's Beehive Cactus (*Coryphantha scheeri*) and Gypsum Wild Buckwheat (*Eriogonum gypsophilum*) have the potential to be present within the vicinity of the Proposed Action.

Scheer's Beehive Cactus is listed by the State as an endangered species. It is a low growing cactus, about the size of a pineapple or beehive. Scheer's Beehive Cactus is typically found in gravelly or silty soils and occasionally on limestone or gypsum benches in nearly level areas in desert grassland and desert scrub (NMRPTC 1999). Threats to the species are primarily from trampling or domestic livestock grazing. This species was not found during the field survey.

Gypsum Wild Buckwheat is listed as a federally threatened species, and endangered by the State. Gypsum Wild Buckwheat is a perennial species with a woody stem that grows to 5 to 8 inches tall. It primarily reproduces vegetatively. This species grows almost exclusively on pure gypsum soils in areas with sparse vegetation (NMRPTC 1999). Threats to this species include grazing, domestic livestock grazing, and gypsum mining.

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## **3.6.2. Impacts from the No Action Alternative**

### **Direct and Indirect Impacts**

The No Action Alternative would deny the approval of the Proposed Action and would not grant permission for Intrepid to access public lands in order to expand solution mine operations to produce potash. Current land and resource use would continue under current conditions in the project area.

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## **3.6.3. Impacts from the Proposed Action**

### **Direct and Indirect Impacts**

Direct and indirect impacts to vegetation resources include short-term impacts resulting from construction related activities and long-term impacts resulting from the presence of permanent facilities during the operation of the Proposed Action. Short-term impacts would include trampling of herbaceous vegetation and removal of vegetation during construction activities. Long-term impacts would include permanent loss of vegetation for operational facilities and the conversion of shrub-dominated land cover types to grass/forb-dominated land cover types. Long-term impacts could also result due to groundwater withdrawals for operational activities. Impacts to vegetation from groundwater drawdown are described in Section 4.7 of the HB EIS (BLM 2012).

Short-term construction activities associated with trenching of the proposed pipelines, installation of the injection and extraction well pads, installation of the booster pump station, and installation of overhead power-runs to well heads, as described in Section 2.2, would directly impact approximately 84.4 acres of vegetation resources. Approximately 33.7 acres is already disturbed and 27.6 acres is adjacent to disturbed areas. Direct construction impacts to vegetation are summarized in **Table 3.6-2 - Proposed Action Construction Land Cover Type Disturbances**.

**Table 3.6-2 Proposed Action Construction Land Cover Type Disturbances**

<b>Land Cover Type</b>	<b>Total Disturbance (acres)</b>	<b>New Area Disturbance (acres)</b>	<b>Within Prior Disturbed Area Disturbance (acres)</b>
Apacherian-Chihuahuan Mesquite Upland Scrub	49.7	28.2	21.5
Apacherian-Chihuahuan Piedmont Semi-Desert Grassland and Steppe	0.9	0.3	0.6
Chihuahuan Creosotebush, Mixed Desert and Thorn Scrub	30.8	19.7	11.1
Chihuahuan Gypsophilous Grassland and Steppe	0.2	0.0	0.2
Chihuahuan Mixed Salt Desert Scrub	0.1	0.1	0.0
Chihuahuan Sandy Plains Semi-Desert Grassland	0.3	0.3	0.0
North American Warm Desert Wash	0.2	0.2	0.0
Western Great Plains Sandhill Shrubland	1.9	1.9	0.0
Western Great Plains Shortgrass Prairie	0.3	0.0	0.3
<b>Total</b>	<b>84.4</b>	<b>50.7</b>	<b>33.7</b>

Land cover type acreages are rounded up to a tenth of an acre. Slight variations between the total disturbance acres presented in this table and total disturbance acres presents for other resources for similar analyses is due to variations within the various resources datasets used for analysis.

Prepared by: MCC2  
Checked by: BJW1

Following construction, the operation of Proposed Action system components and infrastructure, as described in Section 2.2, would directly impact approximately 47.2 acres of vegetation resources. Approximately 17.5 acres is already disturbed and 14.0 acres is adjacent to disturbed areas. Long-term direct operational impacts to vegetation are summarized in **Table 3.6-3 - Proposed Action Operations Land Cover Type Disturbances**.

**Table 3.6-3 Proposed Action Operations Land Cover Type Disturbances**

<b>Land Cover Type</b>	<b>Total Disturbance (acres)</b>	<b>New Area Disturbance (acres)</b>	<b>Within Prior Disturbed Area Disturbance (acres)</b>
Apacherian-Chihuahuan Mesquite Upland Scrub	27.1	16.1	11.0
Apacherian-Chihuahuan Piedmont Semi-Desert Grassland and Steppe	0.8	0.2	0.6
Chihuahuan Creosotebush, Mixed Desert and Thorn Scrub	17.6	12.0	5.6
Chihuahuan Gypsophilous Grassland and Steppe	0.1	0.0	0.1

<b>Land Cover Type</b>	<b>Total Disturbance (acres)</b>	<b>New Area Disturbance (acres)</b>	<b>Within Prior Disturbed Area Disturbance (acres)</b>
Chihuahuan Mixed Salt Desert Scrub	0.1	0.1	0.0
Chihuahuan Sandy Plains Semi-Desert Grassland	0.2	0.2	0.0
North American Warm Desert Wash	0.1	0.1	0.0
Western Great Plains Sandhill Shrubland	1.0	1.0	0.0
Western Great Plains Shortgrass Prairie	0.2	0.0	0.2
<b>Total</b>	<b>47.2</b>	<b>29.7</b>	<b>17.5</b>

Land cover type acreages are rounded up to a tenth of an acre. Slight variations between the total disturbance acres presented in this table and total disturbance acres presents for other resources for similar analyses is due to variations within the various resources datasets used for analysis.

Prepared by: MCC2  
Checked by: BJW1

Indirect impacts to vegetation during construction and vehicle travel during operation would include the potential colonization of noxious and invasive weeds, fugitive dust, and fragmentation of land cover types. The colonization of noxious and invasive weeds would impact vegetation resources by degrading and modifying native vegetation types.

## Mitigation Measures

Throughout the construction and operation of the Proposed Action several best management practices would be utilized to minimize impacts to vegetation resources as described in Section 2.2 of this EA. Additional mitigation measures include the following:

- Areas disturbed due to the construction and operations of Proposed Action system components and infrastructure would be inspected for the presence of noxious and invasive weeds.
- If noxious and invasive weeds become established, BLM approved weed control methods would be utilized to eradicate the noxious and invasive weeds.

### 3.6.4. Impacts from Alternative

#### Direct and Indirect Impacts

Direct and indirect vegetation impacts associated with the alternative proposed pipeline route and subsequent operation of the proposed p would remain consistent with the impacts described for the proposed project, with the exception of the number of disturbed acres.

Short-term construction activities associated with trenching of the alternative pipelines, installation of the injection and extraction well pads, installation of the booster station, and installation of overhead power-runs to well heads, as described in Section 2.2, would directly impact approximately 75.2 acres of vegetation resources. Approximately 43.3 acres is already disturbed. Direct construction impacts to vegetation are summarized in **Table 3.6-4 - Alternative Construction Land Cover Type Disturbances**.

**Table 3.6-4 Alternative Construction Land Cover Type Disturbances**

<b>Land Cover Type</b>	<b>Total Disturbance (acres)</b>	<b>New Area Disturbance (acres)</b>	<b>Within Prior Disturbed Area Disturbance (acres)</b>
Apacherian-Chihuahuan Mesquite Upland Scrub	39.7	17.0	22.7
Apacherian-Chihuahuan Piedmont Semi-Desert Grassland and Steppe	1.8	0.2	1.6
Chihuahuan Creosotebush, Mixed Desert and Thorn Scrub	32.6	14.2	18.4
Chihuahuan Gypsophilous Grassland and Steppe	0.2	0.0	0.2
Chihuahuan Mixed Salt Desert Scrub	0.1	0.1	0.0
Open Water	0.1	0.1	0.0
Western Great Plains Saline Depression Wetland	0.0	0.0	0.0
Western Great Plains Sandhill Shrubland	0.3	0.3	0.0
Western Great Plains Shortgrass Prairie	0.4	0.0	0.4
<b>Total</b>	<b>75.2</b>	<b>31.9</b>	<b>43.3</b>

Land cover type acreages are rounded up to a tenth of an acre. Slight variations between the total disturbance acres presented in this table and total disturbance acres presents for other resources for similar analyses is due to variations within the various resources datasets used for analysis.

Prepared by: MCC2  
Checked by: BJW1

Following construction of pipelines along the alternative route, the operation of proposed project system components and infrastructure, as described in Section 2.2, would directly impact approximately 42.3 acres of vegetation resources. Approximately 22.3 acres is already disturbed. Long-term direct operational impacts to vegetation for the alternative are summarized in **Table 3.6-5 - Alternative Operations Land Cover Type Disturbances**.

**Table 3.6-5 Alternative Operations Land Cover Type Disturbances**

<b>Land Cover Type</b>	<b>Total Disturbance (acres)</b>	<b>New Area Disturbance (acres)</b>	<b>Within Prior Disturbed Area Disturbance (acres)</b>
Apacherian-Chihuahuan Mesquite Upland Scrub	22.0	10.4	11.6
Apacherian-Chihuahuan Piedmont Semi-Desert Grassland and Steppe	1.2	0.1	1.1
Chihuahuan Creosotebush, Mixed Desert and Thorn Scrub	18.6	9.3	9.3
Chihuahuan Gypsophilous Grassland and Steppe	0.1	0.0	0.1
Open Water	0.0	0.0	0.0

Land Cover Type	Total Disturbance (acres)	New Area Disturbance (acres)	Within Prior Disturbed Area Disturbance (acres)
Western Great Plains Sandhill Shrubland	0.2	0.2	0.0
Western Great Plains Shortgrass Prairie	0.2	0.0	0.2
<b>Total</b>	<b>42.3</b>	<b>20.0</b>	<b>22.3</b>

Land cover type acreages are rounded up to a tenth of an acre. Slight variations between the total disturbance acres presented in this table and total disturbance acres presents for other resources for similar analyses is due to variations within the various resources datasets used for analysis.

Prepared by: MCC2  
Checked by: BJW1

## 3.7. Wildlife and Fish

### 3.7.1. Affected Environment

#### Terrestrial Wildlife

Within the project area the main wildlife habitat types are desert scrub, mesquite upland scrub, and grasslands, with small areas of open water, saline depression wetland, woody riparian, active and stabilized dune, warm desert wash, caves, and emergent marsh. This varying habitat offers support for a variety of wildlife species from different taxonomic groups. This section provides basic information on species potentially occurring within and around the Proposed Action and may be sensitive to disturbance or of special concern to one of the agencies responsible for the well-being of that species.

Big game species have the potential to occur within and around the Proposed Action. Potential big game species include mule deer (*Odocoileus hemionus*), pronghorn (*Antilocapra americana*), javelina (*Dicotyles tajacu*), and mountain lion (*Felis concolor*) (BLM 2007b). Mule deer are found east of the Pecos River in isolated areas that have adequate permanent water sources, adequate cover, abundant food sources (shinnery oak), and some topographic relief. Pronghorn habitat consists of the prairie grasslands and shinnery oak dunes. Javelinas prefer habitat areas of mixed desert shrub or mesquite grassland. Mountain lions may occasionally travel through the mesquite grasslands and shinnery oak dune areas in and near the Proposed Action area.

A number of small game species have the potential to occur within and around the Proposed Action. Potential species could include mourning dove (*Zenaidura macroura*), scaled quail (*Callepepla squamata*), bobwhite quail (*Colinus virginianus*), black-tailed jackrabbit (*Lepus californicus*), and desert cottontail (*Sylvilagus audubonii*) (BLM 2007b). Bobcat (*Lynx rufus*), coyote (*Canis letrans*), raccoon (*Procyon lotor*), and badger (*Taxidea taxus*) could also occur within and around the Proposed Action area as well.

Non-game species, such as mammals, raptors, passerines, amphibians, and reptiles, have the potential to occur within the diverse habitat types located around and within the Proposed Action area. Non-game mammals potentially occurring within and around the project boundary include bats, mice, shrews, squirrels, rabbits, and rats. These small mammals provide a prey base for the predators, such as mammals (coyote, badger, skunk), raptors (eagles, hawks, accipiters, owls), and reptiles.

Nongame birds encompass a variety of passerine and raptor species, these include a diversity of neotropical migrants (birds that breed in North America and winter in the neotropical region of South America). These birds are considered integral to natural communities and act as environmental indicators due to their sensitivity to environmental changes. Common bird species that occur within and around the project boundary may include, but are not limited to, horned lark (*Eremophila alpestris*), western meadowlark (*Sturnella neglecta*), Chihuahuan raven (*Corvus cryptoleucus*), western kingbird (*Tyrannus*

*verticalis*), sage sparrow (*Amphispiza belli*), and lesser prairie-chicken (*Tympanuchus pallidicinctus*) (BLM, 2007b). Representative raptor species include the golden eagle (*Aquila chrysaetos*), red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni*), rough-legged hawk (*Buteo lagopus*), ferruginous hawk (*Buteo regalis*), American kestrel (*Falco sparverius*), and great-horned owl (*Bubo virginianus*) (BLM 2007b).

#### Aquatic Species

No fisheries occur within and around the project boundary. The closest perennial stream to the Proposed Project is the Pecos River, which is approximately 14 miles away. The Pecos River supports warm water fisheries. Other aquatic organisms may occupy karst features such as sinkholes, within and around the project boundary. Two troglobitic species, a new species of amphipod and a new species of cocopod, were found in the karst aquifers of Burton Flat during a biological survey for the HB EIS.

#### Special Status Species

The Proposed Action lies within and adjacent to areas that have been identified as habitat areas for special status species lesser prairie-chicken and dunes sagebrush lizard (*Sceloporus arenicolus*) as determined in the Special Status Species ROD and Approved RMPA (BLM 2008). The special status species habitat area for these two species in relationship to the project boundary is shown in **Map EA-22 - Wildlife Map**.

In addition to the lesser prairie-chicken and the dunes sagebrush lizard, several other special status species have the potential to occur within project boundary, based on the sensitive species analysis conducted for the EIS as described in Section 3.8.3 of the HB EIS (BLM 2012). **Table 3.7-1 - Special Status Species Potentially Occurring Within the Project Area** provides a summary of the special status species that may potentially be present.

**Table 3.7-1 Special Status Species Potentially Occurring Within the Project Area**

<b>Common Name (Scientific Name)</b>	<b>Status</b>	<b>Habitat Information</b>	<b>Notes</b>
Pale Townsends's big-eared bat ( <i>Corynorhinus townsendii pallescens</i> )	BLM, USFWS	This subspecies relies on caves, inactive mines, trees, and manmade structures for roosting. Mixed grass prairies, piñon-juniper woodlands, desert shrublands, and coniferous forests are likely habitat types for the bat.	This is the only bat subspecies common to New Mexico in the wintertime.
Cave Myotis ( <i>Myotis velifer incautus</i> )	BLM	This bat uses caves, tunnels, mine shafts, bridges, and even old barn swallow nests and the undersides of bridges to roost. Populations are scattered and their presence is dependent on sufficient roosting habitat. Usually found not far from riparian areas.	The cave myotis prefers to roost in small enclosed, crevices, holes, or pockets of caves, mines, and buildings.
Brazilian free-tail bat ( <i>Nyctinomops mactotis</i> )	BLM	Forests and cliff faces are the preferred habitat types of this species. Cracks and fissures along rock walls provide hibernacula and coniferous forests with ponderosa pine, and douglas fir are prime areas for feeding and roosting.	This species is found most often below 6,000 ft altitude, and rarely up to 8,000 ft.



<b>Common Name (Scientific Name)</b>	<b>Status</b>	<b>Habitat Information</b>	<b>Notes</b>
Fringed Myotis ( <i>Myotis thysanodes thysanodes</i> )	BLM	This species has a wide range of potential habitats, from montane forests, riparian woodlands, and mixed coniferous forests, to mixed shrub, grassland, sage brush, and even cropland.	Roosting sites include caves, mines, and buildings often near a water source.
Long-legged myotis ( <i>Myotis volans interior</i> )	BLM	Largely a forest species, the long-legged myotis utilizes cottonwood trees in riparian woodlands, and ponderosa or piñon-juniper woodlands on mountainsides.	This species roosts primarily in trees, often aspen, douglas fir, or sycamores.
Western small-footed myotis ( <i>Myotis ciliolabrum melanorhinus</i> )	BLM	This species is common among willow lined stream banks and other riparian habitat, as well as coniferous forests and grasslands.	This species has been known to roost in caves, rock crevices, under bark and rocks, and in burrows.
Yuma myotis ( <i>Myotis yumanensis yumanensis</i> )	BLM	This species is closely associated with permanent water sources and riparian habitat; however it is also present in upland areas where juniper-piñon woodlands are dominant.	Mainly feeds in open surface water habitat for insects. Primarily present in the 4,000 to 7,000 ft elevation range.
Swift fox ( <i>Vulpes velox velox</i> )	BLM, USFWS	Short- and mid-grass prairie and grassland or open shrubland with flat or gentle topography suited for hunting and burrowing.	Preys on small rodents such as the kangaroo rat ( <i>Dipodomys</i> spp.) and rabbits. Has been documented capturing and eating insects.
Burrowing owl ( <i>Athene cunicularia hypagaea</i> )	BLM, USFWS	Open grasslands, croplands, and semi desert shrublands. Requires dry, open, flat areas for nesting.	Often nests in abandoned prairie dog, badger, or fox burrows in dry, open terrain.
Loggerhead shrike ( <i>Lanius ludovicianus excubitorides</i> )	BLM	Native grasslands, open desert shrub with creosote bush ( <i>Larrea tridentate</i> ) and areas high in native, herbaceous forbs.	Also found in ponderosa pine, douglas fir, and aspen forest types.
Baird's sparrow ( <i>Ammodramus bairdii</i> )	USFWS, NM-T	Short grass prairie, desert grasslands, and mountain meadows up to 3,600 ft.	Temporary migrant in New Mexico.
Gray vireo ( <i>Vireo vicinior</i> )	NM-T	Open woodlands and shrublands dominated by junipers and oaks, sometimes with mixed conifer forests. Often found in proximity to a water source.	Foothills and mesas, with well-developed grass component are favored by this species.

<b>Common Name (Scientific Name)</b>	<b>Status</b>	<b>Habitat Information</b>	<b>Notes</b>
Texas horned lizard ( <i>Phrynosoma cornutum</i> )	BLM	This species lives in open, dry desert with sparse vegetation, and relies on loose sand and soil or rocks to hide under.	The Texas horned lizard feeds almost exclusively on ants but will eat other invertebrates like beetles as well.
Lesser prairie-chicken ( <i>Tympanuchus pallidicinctus</i> )	FT, BLM	Open grasslands of short-to mid-grass prairie with intermittent sagebrush and shinnery oak components is vital to this species. Open areas on hilltops or ridgelines are used as "lekking" spots which is where the mating courtship takes place. Shrubs and grasses are necessary for nesting and feeding.	In the southeastern part of New Mexico, lesser prairie-chickens exist in the shrub-dominated High Plains Bluestem habitat type in mixed stands of tall grasses (i.e., sand bluestem, little bluestem) and shinnery oak.
Sand dune lizard ( <i>Sceloporus arenicolus</i> ) *Dunes sage brush lizard	BLM, NM-E	An open sand dune with shinnery oak is the habitat in which this reptile lives. Rarely is the sand dune lizard found more than 4-6 ft away from a shinnery oak plant. The dunes have to be active or semi-active, as it seems that when a dune becomes completely stabilized by vegetation and covered with grasses it is no longer suitable habitat for this lizard. The open sand is needed to bury eggs within.	Because of its close association with shinnery oak and active sand dunes, this reptile is somewhat limited in where it can survive and therefore highly sensitive to disturbance. Significant reductions in sand dune lizard populations are associated with the removal of shinnery oak.

Notes:

BLM = BLM sensitive: New Mexico State Office (NMSO)

FT = Federally listed as threatened

NM-E = State-listed as endangered in New Mexico

NM-T = State-listed as threatened in New Mexico

USFWS = USFWS species of concern

Prepared by: JBK

Checked by: MCC2

Source: BISON-M (2015)

Pursuant to Executive Order (EO) 13186 (2001), a Memorandum of Understanding between the BLM, United States Forest Service, and USFWS was drafted in order to promote conservation and protection of migratory birds. The EO provides guidance to federal agencies to minimize adverse effects and promote best management practices for the conservation of migratory birds.

#### Wildlife Survey

A burrowing owl and raptor nest survey was conducted by biologists along the proposed and alternative pipeline routes, the well sites, and within 200 meters of the proposed ROW on February 18 and 19, 2015. During the surveys, two long-eared owls (*Asio otus*) and one Cooper's hawk (*Accipiter cooperii*) were flushed. One raptor nest, whitewash, and castings suggesting the presence of raptors were also observed. No evidence of burrowing owls was observed. Small mammal burrows were observed throughout the length of the pipeline routes. The locations of observation made during the surveys are shown on Map EA-22. A survey narrative, datasheets, photos, and a map showing locations of the survey observations are provided in Appendix G.

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### ***3.7.2. Impacts from the No Action Alternative***

#### **Direct and Indirect Impacts**

The No Action Alternative would deny the approval of the proposed project and would not grant permission for Intrepid to access public lands in order to expand solution mine operations to produce potash. Current land and resource use would continue under current conditions in the project area.

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### ***3.7.3. Impacts from the Proposed Action***

#### **Direct and Indirect Impacts**

Impacts to wildlife include short-term impacts resulting from construction related activities and long-term impacts resulting from the presence of permanent facilities during the operation of the Proposed Action. Short-term impacts to wildlife would include direct disturbance of wildlife habitat and indirect reduction in habitat quality due to increased human activity. Long-term impacts would include direct habitat loss due to the presence of operational facilities and indirect reduction in habitat quality due to increased human activity associated with the operation of the Proposed Action.

Construction activities associated with trenching of the proposed action pipelines, installation of the injection and extraction well pads, installation of the booster pump station, and installation of overhead power-runs to well heads, as described in Section 2.2 of this EA, would result in approximately 84.7 acres of surface disturbance. Impacts to big game species (primarily pronghorn and mule deer) include the loss of forage and would result in minor habitat fragmentation from the installation of new infrastructure. Herbaceous species and grasses may become established within 3 to 5 years, depending on reclamation success. Suitable habitat adjacent to construction disturbance areas (new pipelines, transmission lines, maintenance roads, and well pads) would be available for these big game species until grasses and woody vegetation are reestablished within the construction disturbance areas. The predominant vegetation that would be affected by construction disturbance is Mesquite Upland Scrub and Desert Scrub. These vegetation types would be replaced by native grasses and herbaceous plants during initial reclamation, which would attract big game species as well as many small game and nongame species that utilize grasslands and herbaceous feed and cover.

Impacts to small nongame species would include nest or burrow abandonment or loss of eggs or young from the removal or crushing of natural habitat during construction due to disruption from human activity. Wildlife movements within the project area would be directly altered only during the installation of the pipelines while the trenches are open. After the installation of pipelines, direct impacts to wildlife movement are not expected as all pipelines would be buried.

Construction would result in the mortality of some less mobile or burrowing nongame species (e.g., small mammals, nesting birds, reptiles, amphibians, invertebrates) as a result of crushing from vehicles and construction equipment. Other impacts include the short-term displacement of some of the more mobile species (e.g., medium-sized mammals, adult birds) as a result of surface disturbance activities. The habitats adjacent to the proposed disturbance areas may support some displaced animals. If surface-disturbing activities occur near nesting sites during the breeding season for passerines (approximately March 1 through August 31), impacts would result in nest or territory abandonment, loss of eggs or young resulting in the loss of productivity for the breeding season. For species protected under the MBTA, the loss of an active nest site, incubating adults, eggs, or young would be a violation of the MBTA. However, the extent of impacts to nesting birds would depend on the nest location relative to the actual locations of construction, the phase of the breeding period, and the level and duration of the disturbance.

Bats in the area could be attracted to the evaporation ponds by insects swarming around lights. These bats could then potentially drink from the evaporation ponds. The effects on bats from drinking brine from the ponds have not been determined.

During operations, direct impacts to wildlife species from the operation and maintenance activities associated with the operation of the Proposed Action would include long-term habitat loss or alteration of potential breeding or foraging habitats until native vegetation has become reestablished. Indirect impacts to wildlife species would result from the increase in habitat disruption from the increase of vehicle traffic and human presence for operation and maintenance activities. Over time, most wildlife species should become acclimated to the noise and human presence resulting from the operation of the Proposed Action.

## Mitigation Measures

Throughout the construction and operation of the Proposed Action several best management practices would be utilized to minimize impacts to wildlife and fish as described in Section 2.2. Lights at the solar evaporative ponds would be turned off when harvesting was not taking place, approximately April through July of each year. A bat use survey would be conducted at the solar evaporative ponds to determine if bats are drinking from the solar ponds.

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### 3.7.4. Impacts from Alternative

#### Direct and Indirect Impacts

Direct and indirect wildlife and fish impacts associated with the alternative action and subsequent operation of the proposed project would remain consistent with the impacts described for the Proposed Action, with the exception of the number of disturbed acres during construction.

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## 3.8. Rangelands and Livestock Grazing

### 3.8.1. Affected Environment

The following section presents range management activities for the project area. The study area for range resources is defined as the project area and is represented in **Map EA-23 – Range Allotments**. There are three grazing allotments that occur in the project area, all of which are cattle allotments. Two allotments also show horses on the permit (Clayton Basin and Twin Wells North). **Table 3.8-1 – Grazing Allotments in the Project Area** summarizes each grazing allotment within the project area, including acreage calculations, current stocking rates, and permitted uses. **Table 3.8-2 – Range Allotment Disturbance in Acres** summarizes the surficial disturbance from pipelines, well pads, booster pump station, and power lines from the Proposed Action and Alternative routes of the pipeline. The proposed and alternative pipeline routes each cross 3 pasture fences, one rangeland allotment boundary, and one livestock freshwater pipeline.

All of the surficial disturbances represent a short term loss that would most likely be recovered within 3-5 growing seasons. Land ownership is primarily public with a small portion of each allotment encompassing private land. Additional details regarding rangelands and livestock grazing, such as grazing allotments in existing pipeline ROWs and management categories, are described in Section 3.9 of the HB EIS (BLM 2012).

**Table 3.8-1 Grazing Allotments in the Project Area**

Grazing Allotment Name	Total Allotment Active AUMs	Allotment Acreage Within the Project	Projected Active AUMs Within Project	Livestock		Season of Use	% of Public Land
				Type	Number		
Clayton Basin	10,200	1,311	154	Cattle/Horses	1,000	Yearlong	85
Twin Wells North	11,664	15,476	2,831	Cattle/Horses	1,200	Yearlong	81

Notes:

1. The number and class of livestock, active AUMs, and stocking rates come from the full grazing permit numbers.
2. Burton North, while in the project area, would not include any project infrastructure or disturbance.

AUM: Animal unit month

Prepared by: BAL3  
Checked by: MJH5

**Table 3.8-2 Range Allotment Disturbance in Acres**

Grazing Allotment Name	Proposed Action Route		Alternative Route	
	Construction (50 ft)	Operational (25 ft)	Construction (50 ft)	Operational (25 ft)
Clayton Basin	5.0	2.9	5.0	2.9
Twin Wells North	79.2	44.0	69.9	39.3
<b>Total</b>	84.2	46.9	74.9	42.2

Prepared by: BAL3  
Checked by: MJH5

Water sources for livestock include intermittent and ephemeral streams, lakes, and stock ponds. Water related range improvements in the project area include base water sources, water wells and water storage, troughs, and wells (**Table 3.8-3 - Water Related Range Improvements Within the Project Area**).

**Table 3.8-3 Water Related Range Improvements Within the Project Area**

Grazing Allotment Name	Trough	Water Well and Storage	Livestock Pipeline
Clayton Basin	—	—	—
Twin Wells North	10	1	8 miles
<b>Total</b>	<b>10</b>	<b>1</b>	<b>8 miles</b>

Source: BLM 2012

Prepared by: BAL3  
Checked by: MJH5

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### **3.8.2. Impacts from the No Action Alternative**

#### **Direct and Indirect Impacts**

The No Action Alternative would deny the approval of the proposed project and would not grant permission for Intrepid to access public land in order to expand solution mine operations to produce potash. Current land and resource use would continue under current conditions in the project area.

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### **3.8.3. Impacts from the Proposed Action**

#### **Direct and Indirect Impacts**

The loss of 84.2 acres of vegetation during construction and 46.9 acres of vegetation during operation would not affect the AUMs authorized for livestock use in this area. There would only be a temporary disturbance of 14 AUMs during the construction phase, and 6 AUMs during the operation phase. Several existing fences and one livestock water pipeline, shown in **Map EA-24 – Range Allotments Features**, may be affected during the construction of the pipeline and overhead power-runs.

There are occasional livestock injuries or deaths due to accidents such as collisions with vehicles, falling into excavations, and ingesting plastic or other materials present within the project area. If further development occurs, the resulting loss of vegetation could reduce the AUMs authorized for livestock use in this area. If a pipeline leak developed and brine reached the land surface from the buried pipeline the brine could kill vegetation and reduce the AUMs authorized for livestock use in that area. If fences are temporary down or gates are left open this could either disrupt the livestock rotation scheme or accidentally allow cattle to move into another allotment. If the livestock freshwater supply pipeline is damaged during construction cattle could lose their water supply until the damage is repaired.

The impacts to the ranching operation are reduced by standard practices such as utilizing existing surface disturbance, minimizing vehicular use, placing parking and staging areas on caliche surfaced areas, always closing gates, not leaving fences open, and quickly establishing vegetation on the reclaimed areas.

#### **Mitigation Measures**

Throughout the construction and operation of the Proposed Action several best management practices would be utilized to minimize impacts to rangelands and livestock grazing as described in Section 2.2.

- In the event of a pipeline leak, Intrepid would contain and clean up the spill area in accordance with the permit conditions stated in Discharge Permit DP 1681 and other applicable BLM or State requirements.
- If a livestock pipeline is crossed during construction activities the pipeline would be protected to prevent damage.

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### **3.8.4. Impacts from Alternative**

#### **Direct and Indirect Impacts**

The loss of 74.9 acres of vegetation during construction and 42.2 acres of vegetation during operation would not affect the AUMs authorized for livestock use in this area. There would only be a temporary disturbance of 12 AUMs during the construction phase, and 6 AUMs for the operation phase. Livestock injuries or deaths due to accidents such as collisions with vehicles, falling into excavations, and ingesting plastic or other materials present at the work site could occur. If further development occurs, the resulting loss of vegetation could reduce the AUMs authorized for livestock use in this area.

## 3.9. Lands and Realty

### 3.9.1. Affected Environment

Land use within and around the project area is currently comprised of livestock grazing, recreation, oil and gas leases with well sites and associated infrastructure, and potash mining with associated infrastructure. Due to the nature of the existing land uses, construction and operation associated with the proposed project will temporarily interrupt current land use within small portions of the project area. There are no areas with wilderness characteristics within or near the Proposed Action. Hunting, off highway vehicle (OHV) use, camping, wildlife viewing, and picnicking are common recreational activities. Recreational activities are further discussed in Section 3.10.

Land ownership within the project boundary is summarized in **Table 3.9-1 - Land Ownership** and shown in **Map EA-25 - Surface Ownership**. Land owned by the federal government is administered by the BLM and Trust lands granted to the State of New Mexico are managed by the New Mexico State Land Office (SLO).

**Table 3.9-1 Land Ownership**

Ownership	Percent Ownership	Acres
Federal Lands	77	14,184
State Trust Lands	20	3,603
Private	3	560
Total	100	18,347

Prepared by: MCC2  
Checked by:BJW1

STH 360 extends across the central portion of project boundary in a northwest-southeast/south direction. Two pipeline crossings would intersect the STH 360 ROW within the proposed project area. Intrepid would obtain the appropriate permits for these crossing through the NMDOT. Additionally, CR 222/Shugart Road and County Road (CR) 235/Curry Comb Road initiate from within the southernmost part of the project boundary and run northeast and northwest, respectively. Most of the roads within and around the project boundary are BLM- and State-authorized ROWs, but there are a number of secondary, non-maintained two-track roads.

A number of existing BLM- and State-permitted ROWs lie within project boundary. ROWs for oil and gas pipelines, electric power lines, roads, telephone lines and fiber optic cables, and water pipelines are permitted within the project area and are shown in the following figures:

**Map EA-26 – Oil and Gas ROWs in the HB AMAX Extension Boundary**

**Map EA-27 – Electric ROWs in the HB AMAX Extension Boundary**

**Map EA-28 – Road ROWs in the HB AMAX Extension Boundary**

**Map EA-29 – Telephone/Fiber Optic ROWs in the HB AMAX Extension Boundary**

**Map EA-30 – Water ROWs in the HB AMAX Extension Boundary**

Additional information regarding the existing ROWs may be obtained from Appendix A of the *HB Solar Solution Mine Discharge Permit DP-1681 Renewal and Modification Application* (Intrepid Potash Inc./Foth 2015) prepared for the NMED.

### 3.9.2. Impacts from the No Action Alternative

#### Direct and Indirect Impacts

The No Action Alternative would deny the approval of the proposed project and would not grant permission for Intrepid to access public lands in order to expand solution mine operations so to produce

potash. Current land use and resource management would continue under current conditions in the project area.

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### **3.9.3. Impacts from the Proposed Action**

#### **Direct and Indirect Impacts**

The Proposed Action would affect federal lands managed by the BLM and the State. New ROW authorizations may be required for power distribution to the proposed wells and booster pump station. No other new ROWs would be required as all other surface access and disturbance falls within the boundaries of existing State and federal leases. The establishment of new power line ROWs could limit other future land uses within the Proposed Action boundary for the life of the new power distribution network. Other uses common in the area that could be affected include OHV trails and access to oil and gas development.

New access roads would not be gated so they may increase public access for unauthorized OHV or other vehicle use. This unauthorized may require increased notification requirements, signage, and enforcement.

Pipelines would be installed under STH 360 at two locations within the project boundary. Because the pipelines would be bored under the roads, little to no interruption of traffic would occur during construction.

During construction, a minor increase in traffic due to the Proposed Action would be expected. During construction activities there would be increased traffic to and from the project site by service trucks, construction equipment, material delivery, and daily travel by construction workers. The increased traffic to and from the Proposed Action would be well within the capacity of the existing roads.

Subsidence resulting from the operation of the Proposed Action is projected to be minimal as indicated in Section 3.1.3. However, current land uses such as existing oil and gas pipelines could be affected. There are no residences or outbuildings within the area of potential subsidence.

Several utilities within Proposed Action boundary may be affected by the Proposed Action infrastructure, include the crossing of the following approximate number of ROWs:

- 12 oil and gas ROWs;
- 9 electric ROWs;
- 3 road ROWs;
- 3 telephone/fiber optic ROWs; and
- 3 water ROWs.

#### **Mitigation Measures**

Additional mitigation measures are not recommended beyond the design features that are described in Section 2.1. Prior to construction, all ROWs would be field verified and agreements would be made with ROW holders when their ROW is to be crossed by the proposed HB AMAX Solution Mine Extension Project pipelines, roads, and overhead power-runs.

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### **3.9.4. Impacts from Alternative**

#### **Direct and Indirect Impacts**

Direct and indirect lands and realty impacts associated with the proposed Alternative pipeline route and subsequent operation of the Alternative would remain consistent with the impacts described for the Proposed Action, with the exception of the number of existing ROWs that may be impacted. Several



utilities within the project boundary may be affected by the alternative action infrastructure, include the crossing of the following approximate number of ROWs:

- 10 oil and gas ROWs;
- 5 electric ROWs;
- 4 road ROWs;
- 5 telephone/fiber optic ROWs; and
- 5 water ROWs.

## **3.10. Recreation**

### **3.10.1. Affected Environment**

Recreation within the project boundary is currently comprised of OHV activities as well as hunting, camping, and picnicking. All federal public lands in the area are designated as limited, open, or closed to OHV activities. All of the BLM-administered land in the project area is designated as open to OHV use. (Section 3.11 of the HB EIS, BLM 2012).

A portion of the Hackberry Lake Special Recreation Management Area (SRMA) covers the eastern part of the project boundary as shown in **Map EA-31 - Recreation Lands**. This recreation area totals approximately 58,500 acres, and is open for intensive use of motorcycles, ATVs, and other OHVs and is getting frequent use year-round. The Desert Rough Riders hold a Special Recreation Use Permit in the Hackberry Lake OHV Area to hold a 2-day motocross and all-terrain vehicle race each April. The most commonly used parking area for the Hackberry Lake OHV Area is just to the east of the project boundary on the north side of CR 222/Shugart Road.

Approximately, 2,371 acres, or 4 percent, of the Hackberry Lake SRMA lies within the project boundary. The recreation area overlaps approximately 12 percent of the project boundary. Trails within the recreation area typically consist of many turns and steep hill climbs. Camping is allowed in the Hackberry Lake SRMA and facilities include picnic tables, shelters, fire rings, vault toilets, and parking areas at two different locations (trails on the east side and dune complex on the west side of the SRMA). Hunting is another recreational activity that occurs within and around the project boundary. A variety of species including big game, upland birds, and varmints are hunted in the project area.

### **3.10.2. Impacts from the No Action Alternative**

#### **Direct and Indirect Impacts**

The No Action Alternative would deny the approval of the proposed project and would not grant permission for Intrepid to access public lands in order to expand solution mine operations to produce potash. Current land and resource used would continue under current conditions in the project area.

### **3.10.3. Impacts from the Proposed Action**

#### **Direct and Indirect Impacts**

Construction activities would potentially affect recreation activities such as dispersed camping and hunting due to surface disturbance and occupancy during construction. Construction of the Proposed Action infrastructure would generate increased noise and traffic primarily during the day, which may temporarily diminish camping and hunting activities. The presence of new aboveground facilities also would potentially diminish the hunting experience by displacing habitat as well as increasing noise and human presence. Increased project-related traffic on both access roads and BLM roads may tend to reduce tourism and recreational uses in the area. This impact is likely to be minor due to the users being accustomed to existing mineral development and oil/gas operations within the project area.

The Hackberry SRMA receives the highest level of recreational use within the project boundary. Public access to this area may be impeded by increased project-related traffic, especially during construction. Also, increased vehicle and heavy equipment travel in the immediate area of the SRMA may pose a risk to OHV operators on access roads. Infrastructure such as new roads, power lines, and pipelines can interrupt existing recreation trail use. They also can be a hazardous obstacle to OHV users traveling along trails. Pipeline extending to extraction well IP-302 and IP-304 would lie adjacent to OHV trails and would cross existing OHV trails in the area.

Subsidence resulting from the proposed action is expected to be minimal, and is unlikely to affect recreational uses in the Hackberry SRMA because subsidence would be gradual. Uneven ground surface or open cracks in the surface that may result from subsidence may present a safety hazard to OHV riders. However, this type of subsidence has already occurred in the project boundary without adverse effects to recreational users.

## **Mitigation Measures**

Throughout the construction and operation of the Proposed Action, several best management practices would be utilized to minimize impacts to recreation resources as described in Section 2.2 of this EA. Additional mitigation measures include the following:

- To minimize conflicts with recreational users, construction would not occur within the Hackberry Lake SRMA during the Desert Rough Riders organized OHV event in April.
- Pipelines would be buried as soon as possible and signage would be placed on either end of recreation trails during construction to warn approaching riders.
- During all phases of construction, open trenches shall have proper signage notifying trail users of potential hazards. Upon completion of construction, the roads shall be returned to pre-construction condition with no bumps or dips. All vehicle and equipment operators will observe speed limits and practice responsible defensive driving habits.
- As discussed in Section 3.2.3 in the mitigation section of the EA, large erosional features near IP-302 would be stabilized, which would improve existing trail breaches in the area.

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## ***Impacts from Alternative Direct and Indirect Impacts***

Under the Alternative Action, the impacts to recreation would remain the same as for the Proposed Action.

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## **3.11. Visual Resources**

### ***3.11.1. Affected Environment***

As described in Section 3.12 of the HB EIS (BLM 2012), the project boundary is roughly bounded by Fade-A-Way Ridge to the northwest, Loco Hills to the north, Nimenim Ridge to the east and northeast, Maroon Cliffs to the southeast, Mimosa Ridge to the south, and Quahada Ridge to the southwest. The affected environment is characterized by little variety or contrast in vegetation, a variety in colors and contrast of the soil, rock, and vegetation, scattered pools of water that do not dominate the landscape, current oil and gas operations, and current and abandoned potash mining facilities (**Map EA-32 – Visual Resource Management Map**). The project area is sparsely populated.

The BLM is responsible for managing public lands for multiple uses, while ensuring that the scenic values of public lands are considered before allowing uses that may have adverse visual impacts. The BLM accomplishes this by classifying areas according to its Visual Resource Management (VRM) system.

Each VRM class describes the degree of acceptable visual modification (i.e., contrast, color, line, and texture) within a landscape.

There are four classes within the VRM system. Classes I and II are the most valued visual resources, Class III are moderately valued visual resources, and Class IV are the least visually valued resources. The following are the minimum management objectives for each class, based on BLM Handbook H-8410-1, Visual Resource Inventory.

- Class I: This classification is applied to Visual Areas of Critical Environmental Concern, wilderness areas, wild and scenic rivers, and other relatively undisturbed landscapes. Natural ecological changes and very limited management activity are allowed, but should not attract attention.
- Class II: Management activities may be allowed, but the level of change to the characteristic landscape should be low. A contrast may be seen but should not attract attention.
- Class III: The level of change to the characteristic landscape should be moderate and remain subordinate in the existing landscape.
- Class IV: The level of change to the characteristic landscape can be high, but should be minimized.

The project boundary is within an area managed as VRM Class IV, which provides for management activities requiring major modifications of the existing character of the landscape. Management activities may dominate the view and be the primary focus of viewer attention. However, every attempt should be made to minimize the impact of activities through careful location of facilities, minimal disturbance, and repetition of the basic landscape elements of color, form, line, and texture.

The closest lower-level management area is a VRM Class III area located approximately 5.6 miles to the southeast of the Proposed Action as shown in Map EA-32. In Map EA-32, areas that are not designated as VRM Class I, Class II, or Class III can be assumed to be Class IV.

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### ***3.11.2. Impacts from the No Action Alternative***

#### **Direct and Indirect Impacts**

The No Action Alternative would deny the approval of the Proposed Action and would not grant permission for Intrepid to access public lands in order to expand solution mine operations to produce potash. Current land and resource use would continue under current conditions in the project area.

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### ***3.11.3. Impacts from the Proposed Action***

#### **Direct and Indirect Impacts**

Direct impacts to visual resources from the construction and operations of the Proposed Action would result in slight modifications of the view shed due to the construction of buried pipelines and addition of pipeline maintenance roads, well pads, booster pump station, and overhead power-runs. The most frequent viewers would be motorists traveling on STH 360, along the pipeline route, employees actively working in the area, and individuals utilizing the Hackberry Lake SRMA.

Construction of the proposed pipeline would create linear features in the landscape, and cause contrasts in soil color and vegetation types. This would result in a direct short term visual resource impact. The presence of the well pads, booster pump station, and overhead power-runs would create color and textural contrasts resulting in a long term visual impact for the life of operations.

Indirect impacts during construction and operations of the Proposed Action infrastructure would include dust generation from construction activities and vehicle traffic along the pipeline ROW maintained roads. The generation of dust may temporarily reduce visibility.

## **Mitigation Measures**

The following mitigation measures will be used to minimize impacts to visual resources:

- All vegetation cleared during construction would be randomly scattered outside of the construction areas and would not be left in piles or rows. Scattered vegetation would be placed away from trails.
- All areas disturbed during construction would be reclaimed except where required for operational facilities and associated access roads.
- Within the well pads, the immediate area containing the extraction or injection well, the well head piping manifold, and the electrical cabinetry would be surrounded by a shaded chain link fence using colors in accordance with BLM requirements.

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### **3.11.4. Impacts from Alternative**

#### **Direct and Indirect Impacts**

Under the Alternative Action, the impacts to visual resources would remain the same as for the Proposed Action.

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## **3.12. Cultural Resources**

### **3.12.1. Affected Environment**

Cultural resources are definite locations of human activity, occupation, or use identifiable through field inventory (survey), historical documentation, or oral evidence. The term includes archaeological, historic, or architectural sites, structures, or places with important public and scientific uses, and may include definite locations (sites or places) of traditional, cultural, or religious importance to specified social and/or cultural groups. Cultural resources are concrete, material places and things that are located, classified, ranked, and managed through the BLM's Land Use Planning system of identifying, protecting, and utilizing sites for public benefit. Required tribal consultation was conducted as part of the EIS.

There are a number of known eligible cultural resources in the project area. The majority of the proposed project lies on federal land covered by the Permian Basin Programmatic Agreement (PBPA), an alternative to traditional Section 106 compliance. Intrepid has opted to contribute to the PBPA archaeological mitigation fund in lieu of conducting a pedestrian survey.

Portions of the project under the Alternative that cross New Mexico State Trust Land were surveyed by Lone Mountain Archaeological Services, Inc., a contractor permitted by both BLM and the State of New Mexico. No eligible cultural resources were identified within the area of potential effect. The report is on file with the BLM CFO and, for reasons of confidentiality, is not appended to this EA.

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### **3.12.2. Impacts from the No Action Alternative**

#### **Direct and Indirect Impacts**

The No Action Alternative would deny the approval of the proposed project and would not grant permission for Intrepid to access public lands in order to expand solution mine operations to produce potash. Current land and resource use would continue under current conditions in the project area.

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### ***3.12.3. Impacts from the Proposed Action***

#### **Direct and Indirect Impacts**

No impacts would be expected from the Proposed Action.

#### **Mitigation Measures**

The pipeline alignment was rerouted to allow at least a 100 ft. buffer around known cultural sites.

Should discoveries of human remains or funerary objects occur during project construction or operations on federal or State Trust land, Intrepid would cease operations in the area of discovery, protect the remains, and notify the BLM within 24 hours. The BLM would determine the appropriate treatment of the remains in consultation with culturally affiliated Indian Tribe(s) and lineal descendants. Intrepid would be required to pay for treatment of the cultural items independent and outside of the mitigation fund. In all cases it is illegal to remove any type of cultural item from federal or State Trust land.

Any cultural resource (historic site, object, or remains) discovered by the IPNM Intrepid or any person working on the Intrepid's behalf, on State land shall be immediately reported to the SHPO. Intrepid would suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the SHPO. The authorized officer would determine the appropriate actions necessary in order to prevent the loss of significant cultural or scientific values. Intrepid would be responsible for the cost of evaluation and any measures necessary to mitigate the site as determined by the authorized officer with consultation with the Intrepid.

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### ***3.12.4. Impacts from Alternative***

#### **Direct and Indirect Impacts**

No impacts would be expected from the Alternative Action.

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## **3.13. Hazardous Materials, Health and Safety**

### ***3.13.1. Affected Environment***

The affected environment for hazardous materials, health, and safety includes employees, contractors, the public, air, water, soil, vegetation and wildlife that potentially could be affected by an accidental release of hazardous materials and by physical hazards from activities within the proposed project area. The affected environment for hazardous materials, health, and safety for the Proposed Action would remain consistent with the affected environment described in Section 3.14 of the HB EIS (BLM 2012).

---

### ***3.13.2. Impacts from the No Action Alternative***

#### **Direct and Indirect Impacts**

The No Action Alternative would deny the approval of the proposed project and would not grant permission for Intrepid to access public lands in order to expand solution mine operations to produce potash. Aspects related to Hazardous Materials, Health and Safety would be the same as currently exist and analyzed in the EIS.

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### **3.13.3. Impacts from the Proposed Action**

#### **Direct and Indirect Impacts**

Construction of the Proposed Action could pose an environmental and human health hazard. Potential risks would include impacts to human health, wildlife, air, soil and vegetation resulting from spillage, leakage, or improper disposal of fuel, lubricants and other substances. Physical hazards such as use of vehicles, heavy machinery and trenches would potentially pose risks to wildlife and humans.

During operations, potential environmental health hazard risks would include brine leakage from pipelines and well heads, and spillage and improper disposal of fuel, lubricants, and other substances potentially used during maintenance activities. The use of vehicles and heavy machinery and limited excavation associated with inspection and maintenance of the pipelines, well heads and booster pump station are sources of physical hazards during operations.

#### **Mitigation Measures**

Measures to protect environmental and public health and safety would be implemented as described in Section 2. In addition, the HB Solar Solution Mine spill response and cleanup plans would be adapted to cover the Proposed Action to mitigate potential hazardous materials and health and safety.

Following construction all trenches would be backfilled and the booster station and well pads would be encircled by fences to limit physical hazards.

To decrease potential hazardous materials impacts, Intrepid performs regular inspections of pipelines and has automated instrumentation to monitor pipeline and well head operations. In the event of a pipeline or well head release relating to the Proposed Action, Intrepid would implement spill response and cleanup measures and provide appropriate notification to BLM and as otherwise required by State regulations and permits.

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### **3.13.4. Impacts from Alternative**

Under the Alternative Action, the hazardous materials, health, and safety impacts would be the same as for the Proposed Action.

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## **3.14. Socioeconomics and Environmental Justice**

### **3.14.1. Affected Environment**

Eddy County and Carlsbad comprise the primary study area for socioeconomic effects from the Proposed Project. Eddy County provides most public services to the project area and the majority of the project's construction and expanded operations work forces are likely to live in Carlsbad, based on the distribution of Intrepid's current work force (**Table 3.14-1 - Residency Distribution of Intrepid's Current Work Force, February 2015**).

**Table 3.14-1 Residency Distribution of Intrepid's Current Work Force, February 2015**

	<b>Carlsbad (Eddy County)</b>	<b>Loving (Eddy County)</b>	<b>Hobbs (Lea County)</b>	<b>Elsewhere in New Mexico</b>	<b>Out of State</b>	<b>Artesia (Eddy County)</b>	<b>Total</b>
Number of Employees	696	33	20	17	11	8	785
Percent of Total	89%	4%	3%	2%	1%	1%	100%

Source: Intrepid Potash, February 2015.

Prepared by: CED1  
Checked by: BAL3

The construction work force for pipeline construction and well drilling are likely to come from outside of this area and would typically be part of the selected contractor's traveling work force. The construction work force for well pad construction, well head installation, booster pump station, and electrical power lines are more likely to be located in the Eddy County and Lea County areas.

More than 15 motels and several large recreation vehicle (RV) parks are located in Hobbs, nearby Eunice (2008 population 2,771), and the surrounding area in Lea County. These accommodations serve tourists, the region's natural resource industry, and the non-local construction work force for other construction projects in the nearby area.

Included as **Map EA-33 – Proximity to Nearby Communities, Socioeconomics and Environmental Justice** is an area site map that shows the location of nearby communities in relation to the Proposed Action.

#### **Eddy County Population and Demographics**

Eddy County resident population peaked at 53,266 in 1983. Oil and gas development was the major driver of growth as the potash industry had matured and actually experienced declines in production. The most recent information from the U.S. Census Bureau in 2010 estimates that the population in Eddy County increased by 4.2% from 2000 to 2010. The populations of the nearby communities of Carlsbad, Artesia, and Loving increased by 2 to 6% over the same period, with the remainder of the county increasing by 6%.

This information is shown in **Table 3.14-2 - Population Settlement Within Eddy County, 2000 to 2010**.

**Table 3.14-2 Population Settlement Within Eddy County, 2000 to 2010**

<b>Area</b>	<b>2000</b>	<b>2010</b>	<b>Percent Change (2000-2010)</b>
Eddy County	51,658	53,829	4
Carlsbad	25,625	26,138	2
Artesia	10,692	11,301	6
Loving	1,326	1,413	7
Remainder of the County	14,015	14,977	7

Source: U.S. Census Bureau 2010.

Prepared by: CED1  
Checked by: BAL3

Based on 2008 data from the EIS (Section 3.15.3 of the HB EIS, BLM 2012), the median age of Eddy County residents was 37.0 years compared with the median age of 35.0 for New Mexico. However, Eddy County had a larger share of residents under the age of 18.

The local population has a higher percentage share of whites and lower percentage shares of minorities and residents who are Hispanic or Latino than does the statewide population (**Table 3.14-3 - Racial and Ethnic Population Composition, 2013**). There are no Indian reservations in Eddy County, unlike in many parts of New Mexico (Section 3.15.3 of the HB EIS, BLM 2012).

**Table 3.14-3 Racial and Ethnic Population Composition, 2013**

Location	Percent of the Total Population			
	White and not Hispanic or Latino	American Indian and Alaska Native and not Hispanic or Latino	Other Races, Two or More Races, and not Hispanic or Latino	Hispanic or Latino Ethnicity
New Mexico	39.4	10.4	2.9	47.3
Eddy County	50.3	2.3	1.7	45.7

Source: U.S. Census Bureau Quick Facts 2013.

Prepared by: CED1  
Checked by: BAL3

### Environmental Justice

Section 3.15.11 of the HB EIS (BLM 2012) provides an overview of how environmental justice is used to evaluate proposed development projects pursuant to Executive Order (E.O). 12898.

The portion of Eddy County surrounding the project area has a very low population density. In the EIS it was noted that the closest Census Block, the basic unit of geography used to enumerate population in the decennial census, with more than 10 persons is at least 8 miles from the project area. Census Block Group 1 of Census Tract 9, which surrounded that project area, covers 1,567 square miles and had a total population of 2,725 persons (or 1.7 persons per square mile) in 2000. Most of the population is in the surrounding communities of Artesia, Riverside and Loco Hills. The population density outside of these population centers averages less than 1 person per 3 square miles (Section 3.15.11 of the HB EIS, BLM 2012).

The city of Carlsbad is located about 20 miles west of the project area. The city's distance from the project area, its racial and ethnic composition, existence of substantial levels of intervening oil and gas development, lack of identified concerns during scoping, limited scale of incremental impacts, established operations of the mine, and effective land use buffer created by the 2012 Secretary's Order, effectively dismiss Environmental Justice as an issue for the city of Carlsbad.

### 3.14.2. Impacts from the No Action Alternative

#### Direct and Indirect Impacts

Under the No Action Alternative, the Proposed Action would not be developed. Under this alternative, the existing HB Solar Solution Mine and associated HB Mill operation would continue to operate under current permits and authorizations.

### 3.14.3. Impacts from the Proposed Action

#### Direct and Indirect Impacts

Intrepid is not planning on expanding its work force for the Proposed Action. The total number of temporary or construction employees would be 30 (Intrepid Potash Inc./Foth 2015). As shown in Section 3.14.1, population centers are some distance from the location of the Proposed Action. Development of



the project would have little impact on the distribution of population, employment, and personal income in the local area.

### **Mitigation Measures**

Given there are no anticipated direct or indirect impacts from the proposed project, mitigation measures are not necessary.

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#### ***3.14.4. Impacts from Alternative***

### **Direct and Indirect Impacts**

The Alternative Action would be expected to be the same as those described for the Proposed Action.

## 4. CUMULATIVE IMPACTS

### 4.1. Overview

The relevant past and current actions within the project area contributed to the current conditions described as the affected environment in Section 3. For this reason, the cumulative impact analysis included in this section focuses primarily on reasonably foreseeable future actions (RFFA) that are known by the BLM at the time the analysis was performed. The impacts of the proposed HB AMAX Solution Mine Extension Project and the RFFA, along with the effects of the past and current activities that affect the same resources, would combine to have a cumulative impact on the environment in the region.

The activities and proposed projects listed in **Table 4.1-1 – Reasonably Foreseeable Future Actions in the Region** are reasonably foreseeable in the vicinity of the proposed HB AMAX Solution Mine Extension Project and existing HB Solar Solution Mine. The list includes actions that are likely to affect the same resources that were analyzed in Section 3. The areas of potential impacts may vary from one resource to another, and are described for each resource in the following sections. The impacts of these activities on the region over the life of the proposed project (14 years beyond the 28-year HB Solar Solution Mine life) were considered in combination with the proposed HB AMAX Solution Mine Extension Project and existing HB Solar Solution Mine Project, and other past and ongoing activities to predict the potential cumulative effects of all actions combined on each of the resources analyzed in this EA.

**Table 4.1-1 Reasonably Foreseeable Future Actions in the Region**

Project	Brief Description	Approximate Location
1. Hackberry events	Construction work on expanded picnic shelters/camping areas and event staging areas. Special events are expected to increase.	In and around Hackberry Lake Special Recreation Management Area
2. Caliche pits	Sources for this project, amount of increased disturbance.	Within and near project area as located by the contractor
3. BLM vegetation management	As part of the Restore New Mexico program, the BLM plans several chemical treatments to manage invasive plants (mesquite and creosote). Activities could also include brush control and salt cedar eradication and controlled burns. No surface disturbance is planned.	Within and near project area
4. Double Eagle Water Line	The City of Carlsbad is in the process of constructing a new buried water line. It will be completed before construction for this project would start.	Near project area
5. Oil and gas drilling and production	Oil and gas drilling of new wells and production from existing wells would continue in the SPA according to BLM policy and approval. It is anticipated that oil and gas drilling operations would continue at the current rate of 75 per year in the SPA and an average of 1 per year within the project area. An average of 3.5 acres would be disturbed for each new well pad constructed. Activities could also include drill islands which are large, consolidated drilling locations for oil and gas wells and would include associated pipelines, electric lines and other infrastructure.	In the SPA and project area
6. Solution mining projects	Additional solution mining projects may occur in the SPA as potash resources available for conventional mining decline. There are currently no additional proposed solution mines.	In the SPA

Project	Brief Description	Approximate Location
7. Miscellaneous Utilities and public infrastructure	Natural gas distribution lines, transmission lines and solar farms may be reasonably foreseeable. There may also be road construction on 360 and Shugart Road.	Near project area

## 4.2. Geology and Minerals

### Mineral Resources

The proposed HB AMAX Solution Mine Extension Project would provide approximately 14 years of solution mine reserves beyond the 28-year HB Solar Solution Mine life. These reserves would add to the potash resources that were analyzed within the cumulative effects study area (CESA) of southeast New Mexico including Lea and Eddy counties in Section 5.2.2.1 of the HB EIS (BLM 2012). The cumulative impacts to potash resources would incrementally increase with the proposed HB AMAX Solution Mine Extension Project. The cumulative impacts would remain consistent with the impacts presented in Section 5.2.2.1 of the HB EIS (BLM 2012).

The CESA for oil and gas is the Oil Potash Leasing Area (OPLA), defined by OCC Order R-111-P that encompasses most of the SPA. The cumulative impacts to oil and gas resources would remain similar to the cumulative impacts described in Section 5.2.2.2 of the HB EIS (BLM 2012). The addition of the proposed HB AMAX Solution Mine Extension Project would not prevent oil and gas exploration and production in the OPLA where no commercial-grade potash occurs so development and production operations would continue.

### Karst Resources

As indicated in Section 3.1.3 the primary impacts to karst resources would only result from disturbance during pipeline burial, power line installation, and well pad construction. Impacts to karst resources due to groundwater drawdown are not anticipated beyond the impacts addressed in the EIS (BLM 2012) are expected due to the proposed HB AMAX Solution Mine Extension Project. Therefore, the cumulative karst resources impacts described in Section 5.2.3 of the HB EIS (BLM 2012) would continue to remain valid.

### Subsidence

As mentioned in Section 3.1.3, much of the subsidence due to conventional mining has likely occurred already. The additional subsidence due to solution mining is expected to be approximately 0.5 – 1.1 ft. Other projects in the vicinity of the proposed HB AMAX Solution Mine Extension Project are not anticipated to add to this projected subsidence amount within the area of projected subsidence for the HB AMAX Solution Mine Extension Project.

### Paleontology

The generally limited potential for the occurrence of scientifically important fossils that could be affected by activities in the proposed HB AMAX Solution Mine Extension Project area would result in a low potential for adverse impact to paleontological resources. The cumulative impacts are expected to be negligible.

## 4.3. Water

The cumulative effects analysis focused on the past, present, and reasonably foreseeable water conservation plans, additional water depletions, oil and gas development, and recreation.

## **Surface Water**

Cumulative impacts to surface water resources would primarily be related to ground surface disturbance from construction and operation of additional mining and oil and gas development. The cumulative impact to surface water would remain consistent with the cumulative impacts described in Section 5.3.1 of the HB EIS (BLM 2012) with the proposed HB AMAX Solution Mine Extension Project only contributing a minor incremental impact to surface water cumulative impacts.

## **Groundwater**

As indicated in Section 3.2.3, no additional groundwater impacts, besides those already addressed in the HB EIS (BLM 2012) are expected due to the proposed HB AMAX Solution Mine Extension Project. Therefore, the cumulative groundwater resources impacts described in Section 5.3.2 of the HB EIS (BLM 2012) would remain valid.

## **4.4. Soils**

RFFAs that would be expected to produce incremental and cumulative impacts within the analysis area are summarized in Table 4.1-1. These projects would contribute incremental changes to the current level of effects to soil resources described in the analysis area from historic and ongoing management activities.

The cumulative impacts to soil would be similar to the cumulative impacts described for the HB Solar Solution Mine in Section 5.4 of the HB EIS (BLM 2012). Projects that have contributed to cumulative impacts to soils result from surface disturbance associated with mining, grazing, vegetation management, recreation, oil and gas exploration and development, roads, and other natural and anthropogenic activities within the analysis area. Impacts associated with these types of activities include removal of vegetation, exposure of the soil, mixing of soil horizons, soil compaction, and loss of topsoil productivity. These impacts could increase runoff, decrease surface water infiltration, and lead to increased susceptibility of the soil to erosion and sedimentation.

Vegetation management projects may result in a decrease of invasive species and an increase in vegetation with better soil holding capacity, which would be a beneficial impact to soil resources.

With implementation of standard and additional mitigation measures, the proposed project, when added to past, present, and reasonably foreseeable future actions is not expected to result in significant cumulative impacts to soil resources.

## **4.5. Air Quality**

Cumulative impacts to air quality would include impacts from the proposed HB AMAX Solution Mine Extension Project emission sources in combination with impacts from background emissions sources associated with past and present actions and RFFAs. Cumulative air quality impacts in the vicinity of the HB AMAX Solution Mine Extension Project would be minimal as oil and gas development is currently ongoing as described in Section 5.5 of the HB EIS (BLM 2012) for the HB Solar Solution Mine. Additional oil and gas development and plugging and abandoning old wells in the project vicinity would continue at generally the same rate that has been conducted in the past. Because past oil and gas activity is already included in the ambient background concentrations discussed in Section 3.4, total cumulative impacts are expected to remain below the NAAQS and NMAAQs for the region.

## **4.6. Climate Change**

Cumulative impacts to climate change would include impacts from the proposed HB AMAX Solution Mine Extension Project emissions sources in combination with impacts from background emissions sources and RFFAs. Oil and gas development is currently ongoing, and additional oil and gas development in the project vicinity would continue at generally the same rate that has been conducted in the past. Past oil and gas

activity is already included in the 2008 GHG emissions inventory summarized in Section 3.5, and the incremental contribution in addition to the Proposed Project would be small.

## **4.7. Vegetation**

Past, present, and reasonably foreseeable future actions would cumulatively and incrementally reduce vegetation cover types until such time that reclamation is deemed successful and native plants are reestablished. Cumulative losses for vegetation resources potentially would include the reduction of native ecosystem functions such as soil stability, erosion control, livestock and wildlife forage, and wildlife habitat.

As indicated in Section 5.7 of the HB EIS (BLM 2012) for the HB Solar Solution Mine, it is estimated that herbaceous-dominated plant communities would require a minimum of 3 to 5 years to establish adequate ground cover to minimize erosion and provide forage for wildlife species and grazing operations. Woody-dominated plant communities would require 25 to 50 years for shrubs of similar stature to recolonize the area.

In addition to cumulative vegetation loss, other impacts on vegetation likely would occur as a result of cumulative forage use by livestock, and wildlife, affecting plant productivity and vegetation community structure and composition. Indirect impacts to vegetation resources associated with surface disturbance-related activities may include potential colonization of noxious and invasive weeds, fugitive dust, and fragmentation of land cover types. The colonization of noxious and invasive weeds would impact vegetation resources by degrading and modifying native vegetation types.

Noxious weeds and invasive species exist throughout the CESA. Surface disturbance activities from implementation of the proposed HB AMAX Solution Mine Extension Project as well as other future projects could further spread noxious weed and invasive species into previously undisturbed areas, and may increase the acreage and population numbers of already established noxious weed and invasive species populations.

The BLM vegetation treatment projects within the vicinity of the proposed HB AMAX Solution Mine Extension Project and HB Solar Solution Mine boundary seek to increase native grasslands, and reduce the cover and amount of invasive native and non-native shrubs (creosote and mesquite). Successful reclamation of disturbed areas with native grasses and forbs could assist in restoring the native grasslands and other vegetation, and may further the goals of the vegetation treatment programs.

Cumulative impacts to sensitive plant species, such as Scheer's beehive cactus and gypsum wild buckwheat would be unlikely as indicated in Section 5.7.2 of the HB EIS (BLM 2012).

## **4.8. Wildlife and Fish**

Consistent with the methodology for analyzing cumulative impacts to wildlife in Section 5.8 of the HB EIS (BLM 2012), consideration was given to the cumulative effects of the past, present, and reasonably foreseeable mining activities, mining exploration programs, vegetation management, and potential habitat conversion associated with additional water depletion.

Cumulative impacts to terrestrial wildlife and sensitive species detailed in Section 3.7 would be primarily related to habitat loss, habitat fragmentation, and animal displacement and mortality. Nesting birds, small mammals, and reptile species would be the most susceptible to localized activities that remove their native habitat, especially in areas that may be at carrying capacity. Many of the local larger wildlife species that occur in the CESA would be likely to continue to occupy their respective ranges and breed successfully, although population numbers may decrease due to cumulative habitat loss and disturbance from incremental development.

The RFFAs in combination with implementation of the proposed project would result in additional habitat disturbance. While these activities would result in an incremental increase in habitat-related wildlife

impacts, reclamation of disturbed areas would minimize the impacts to wildlife. The BLM vegetation treatment program may have a beneficial cumulative effect on habitat in the CESA over time.

Cumulative impacts to aquatic species associated with the proposed HB AMAX Solution Mine Extension Project are not anticipated.

## **4.9. Rangelands and Livestock Grazing**

In addition to available forage and AUM loss resulting from the RFFAs and proposed HB AMAX Solution Mine Extension Project, the development of access roads and utility corridors would affect livestock grazing activities, livestock management, range facilities, and resources. Range facilities including water sources, fences, and cattle guards, could be adversely impacted by construction and maintenance activities associated with the proposed HB AMAX Solution Mine Extension Project and the other future actions within the CESA. There may be a loss of access to water sources due to the placement and construction of new facilities, roads, and fences. Fences and cattle guards could be damaged or destroyed by operation and maintenance activities, but maintenance and repairs would be required to mitigate damages on public lands.

Past, present, and RFFAs would reduce available acres of forage from active grazing preference during construction activities and where permanent structures or facilities are maintained. Successful reclamation would result in an increase in native grasses that would be available for forage. Grazing may inhibit the re-establishment of woody species in grazing allotments.

## **4.10. Lands and Realty**

As indicated in Section 5.10 of the HB EIS (BLM 2012), resource development has been prominent on the landscape in and around the project area for many years, and with the anticipation of 75 new oil and gas wells a year, this trend is likely to continue. New ROWs within the CESA may open up access to the public where none previously existed and may affect existing and future land uses. The predominant use of the CESA is mining and fluid mineral development. Cumulative impacts to land use and realty are expected to be minimal because the current land uses would continue.

The proposed HB AMAX Solution Mine Extension Project area has a road network in place. Further expansion of this network to accommodate mineral resource development may have adverse and beneficial impacts. Adverse impacts would include an increase in traffic within the CESA and primary access roads, as well as greater maintenance needs on new and existing roads. A potential benefit would include a larger maintained road network that may be utilized by recreational and other land users.

## **4.11. Recreation**

The cumulative impacts to recreation would remain consistent with the cumulative impacts described in Section 5.11 of the HB EIS (BLM 2012). Cumulative impacts to recreational resources within the CESA include access closures (mostly short-term), increased noise and activity associated with resource development, and a reduction in dispersed camping opportunities. Due to previous potash and oil and gas development through the years, the existing road network has reduced the value of primitive recreational values in the area including naturalness, primitive and unconfined recreation, and solitude. Additional roads for mineral development would provide increased easy access to motorized recreational users. This increase in human activities from mineral development and motorized vehicles is likely to have a long-term impact on recreational users such as hunters and hikers who tend to avoid areas that have been heavily developed. While a substantial portion of the CESA would be affected by industrial activities from the proposed project in combination with other RFFAs, there would be minimal overall impact to recreational activities within the CESA.

## **4.12. Visual Resources**

The cumulative impacts to visual resources will be similar to the cumulative impacts presented in Section 5.12 of the HB EIS (BLM 2012). The primary source of cumulative impacts to visual resources would be caused by mineral development. Past, present, and reasonably foreseeable future resource development in the CESA would have both direct and indirect cumulative impacts to visual resources from emissions, ancillary facilities, and the general increase of human activities. In the future, the combination of all mineral development activities may dominate the view and become the major focus of viewer attention. However, the management directive for visual resources for BLM managed lands in the CESA allows for activities that may dominate the view and become the major focus of viewer attention.

## **4.13. Cultural Resources**

The cumulative impacts to cultural resources would remain consistent to the cumulative impacts described in Section 5.13 of the HB EIS (BLM 2012) and the proposed HB AMAX Solution Mine Extension Project is not expected to cumulatively contribute to cultural resources impacts.

## **4.14. Hazardous Materials, Health and Safety**

The cumulative impacts for hazardous materials, health, and safety would remain consistent with the cumulative impacts described in Section 5.14 of the HB EIS (BLM 2012) and the proposed HB AMAX Solution Mine Extension Project is only minimally expected to cumulatively contribute to hazardous materials, health, and safety impacts.

## **4.15. Socioeconomics and Environmental Justice**

The CESA for socioeconomics and environmental justices is Eddy County. Socioeconomic cumulative impacts resulting from the proposed HB AMAX Solution Mine Extension Project are not anticipated and would remain consistent with impact described in Section 5.15 of the HB EIS (BLM 2012). The proposed HB AMAX Solution Mine Extension Project would be developed north of the current HB Solar Solution Mine and would be located far from any population centers. While there is a significant Hispanic minority population in Eddy County, none of these individuals live near the proposed development and therefore there is no possibility that they would be disproportionately affected.

## 5. SUPPORTING INFORMATION

### 5.1. List of Preparers

**Table 5.1-1 BLM Interdisciplinary Team**

<b>Resource/Responsibility</b>	<b>BLM Team Member</b>
Project Manager, Geology and Hydrology	Jessie Hubbling
NEPA Lead	Howard Parman
Caves/Karst	Jim Goodbar
Cultural	Stacy Galassini
Wildlife	John Chopp
Soils, Vegetation, Reclamation	Steve Daly
Recreation, Visual	Deanna Younger

**Table 5.1-2 Foth EA Team**

<b>Resource/Responsibility</b>	<b>BLM Team Member</b>
Project Manager	Julianne Hanson, P.E.
Environmental Analyst	Megan Haserodt

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